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ORIGINAL MEMOIRS.

ON THE USE OF THE MASLAND SAW FOR OPENING THE CRANIAL VAULT.[1]

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ABOUT one year ago when we first presented before The County Medical Society a new cranial saw, utilizing the power-driven circular saw principle, we felt that the ideas involved and the practical applicability were assured.

Since then we have studied carefully the details of construction so as to produce an instrument thoroughly reliable under all circumstances. The only change made in the saw itself has been to increase the diameter of the circular saw, thereby insuring ability to cut through the thickest skull that might be encountered.

The motor is a sixth horse-power, which has been demonstrated strong enough to drive the saw with perfect ease through the hardest bone.

The flexible cable has been made stronger. It is strong enough to stop the motor without injury to the physical condition of either motor or cable.

It will be seen that a motor ample for any demand of power required, and a cable strong enough to drive the saw with certainty and steadiness through the hardest bone,

[1]Read before the Philadelphia Academy of Surgery, April 2, 1906.

and yet stronger than the motor itself, secures a reliability of mechanism above every requirement.

The saw is so simple in construction that it can hardly get out of order. The chief necessity is to see that the bearing of the saw shaft is lubricated with a sterile oil. This is done by dropping, as needed, oil in the oil-hole provided at the side of the bearing.

It is appreciated that this instrument opens the skull with a smaller waste of bone-tissue than any other instrument yet devised. The width of section, but one millimeter, and the bevelled cut, permits the replacement of the bone flap on a firm shelf with insignificant sinking of the flap; securing, in other words, a postoperative condition as substantial as before the skull was cut.

We have demonstrated that the skull can be entered with this instrument by either of two methods of operation, each of which has certain advantages which will recommend the one or the other to different operators. The plan of operation depends upon whether one prefers the inside or the outside guard.

In my former paper, I advocated the use of the outside guard. This method does not require the making of any preliminary openings. The osteoplastic flap is, preferably, four-sided, with the shortest side at the basal portion of the skull. This side is to be left uncut for the retention of the vitality of the flap. With a scalpel the flap is outlined in the soft tissue and the tissue cut to the bone surface.

Leaving the flap adherent to its underlying bone, the tissue on the outer side of the incision is dissected away to allow the easy access of the saw. The guard is then set for a depth that we are reasonably sure will not penetrate the thickness of the skull. The saw is always held with the cable side overhanging the flap. This permits a better observation of the section and makes more easy the bevelling of the incision through the bone. After the first cut, the incision is percussed with a bone-sounder which I have devised for the purpose (Fig. 3). A trained ear can learn

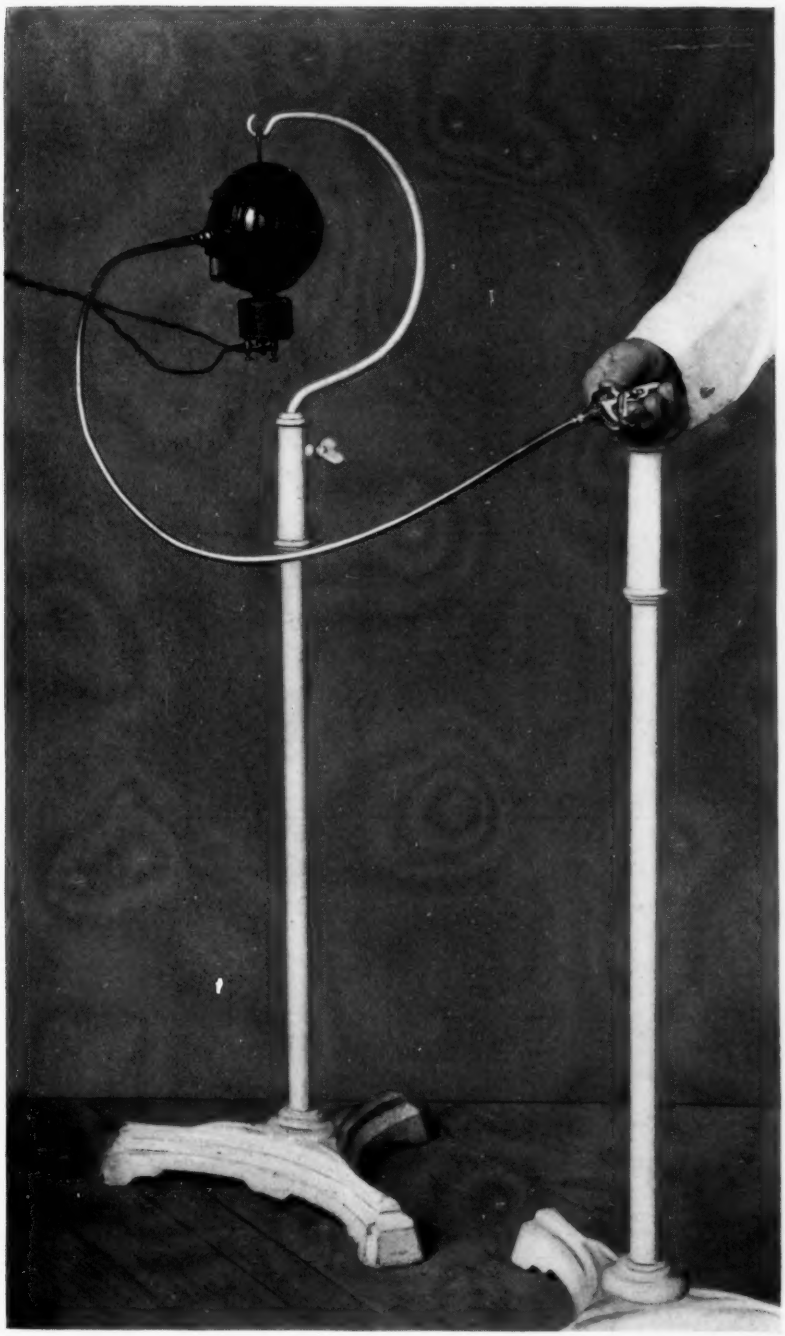

FIG. 1.

from this the relative thickness of the uncut bone. According to one's judgment the guard can then be set coarse or fine. It is possible to set the guard for a difference of one one-hundredth of an inch. Naturally the skill of the operator is called in play in making the final incision through the skull to protect the dura. Only the exercise of undue haste would result in injury to the brain-tissue. After completing the bone sections, soft-tempered steel chisels are inserted in the cut bone at opposite sides of the flap. Springing the flap up with these chisels the remaining short side is broken and the vitality of the flap thus preserved.

It will be seen that the chief problem involved in the use of this saw is to make the section without injury to the

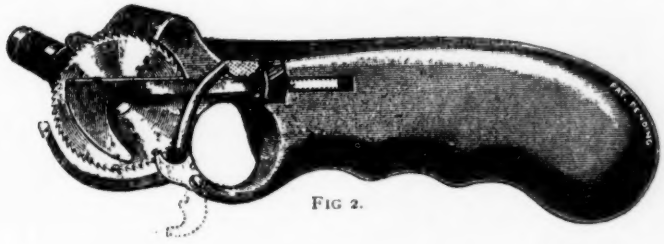

FIG 2.

FIG. 3.

subjacent dura. The saw, rotating 1500 or 2000 revolutions per minute, cuts the bone with practically no pressure on the part of the operator. As to the mere cutting of the bone the question of time is eliminated. The greatest care, however, should be exercised in the final stages of the section. It is true that the tactile sense with this instrument is preserved, and surgeons have expressed the opinion that they could tell when they have entered the skull cavity without the use of the guard. I would advise, however, the taking the time with finely-graded adjustments of the guard to prevent injury to a dura intimately attached to the bone.

In my judgment the chief necessity for this care is to obviate hæmorrhage by cutting a dural vessel. True it is preferable to cut the dura subsequently inside the line of the bone incision to facilitate suturing, but the only ill effect arising from simple cutting of the dura by the saw would be the more troublesome subsequent suturing. Hernia cerebri considering the perfect bony support, is impossible.

FIG. 4.

It is evident that this instrument, notwithstanding its ability to make a flap superior to all others, must still be able to cut the bone with as little or less injury to the sublying tissues than the best of the others, to entitle it to recognition as being distinctly superior.

The method just described will accomplish this better than any other instrument yet devised with the exception of the Cryer drill. I believe however that with the use of

the inside guard on my saw, the dura can be protected from injury with absolute certainty. Using this method the outside guard is discarded. The skin section is made as before mentioned. At the two superior angles of the flap, preliminary openings are made about 3-16 of an inch in diameter, the guard, detached, is then entered in the opening and the dura pressed away from the inner table of the skull. The saw is now used to cut two grooves in the bone chiefly to the outer side of the opening and almost through the bone. (Fig. 4.) These cuts are made in the lines of the intended bone sections. They permit the entry of the guard in a more oblique manner. The shaft of the guard, now attached to the saw, occupies this groove and is supported by its sides. The idea of this groove is to give the saw more room so that it may cut the more easily the bone at the side of the opening. The guard is now kept by the pressure of the thumb on the handle arm in constant contact with the inner wall of the skull, and the incision is advanced. It will be noticed that the guard, to prevent its own destruction, does not come in immediate contact with the teeth of the saw. As a result of this, a thin section of the bone on the inner table of the skull may remain uncut. So soon as the handle-arm of the guard presses upward this condition is in all likelihood present. The advance of the saw is immediately checked, then by pressing the handle of the saw downward, practically rotating it downward with the guard-tip as the pivotal point, the guard sinks deeper and presses the dura away, the saw also sinks deeper and cuts through this remaining portion. The further progress of the incision is then pursued. Starting on a new line of incision the guard is adjusted in the opening and this side of the flap cut as before.

It is always to be borne in mind that when the handle-arm of the guard rises up against the thumb, the advance of the incision should be checked, and the reason for this movement of the guard ascertained. If we find that the bone has been cut through, then it may be an internal ridge

of bone or an adherent dura giving the trouble. Should it be a ridge the only care is to have the guard advance over and past it without deflecting into the deeper tissues. This should give no special trouble. It may be that the dura resists the detachment by the guard. Should this occur it is better to detach the guard from the saw, and using it as a blunt dissector coax the dura away from the bone as far as the guard can be advanced. The saw is then attached and this portion of the bone divided. This process can be repeated as often as necessary. The essence of careful surgery would recommend this as the absolute method of preventing injury to the underlying tissues.

I am confident that the plan of operation I have outlined, which takes longer to tell than to perform, removes with certainty the liability of injuring the dura or producing serious hæmorrhage. The bleeding that would ensue would be the usual bone bleeding that is expected.

The subsequent breaking of the undivided side of the bone-flap is performed as before, and is familiar to all.

In claiming for this instrument a superiority as to method and results over all other instruments used for the purpose, it may be well to mention some of the chief disadvantages of these instruments and show wherein this new one excels.

The hand trephine, descended to us from remote antiquity, requires but little notice. Its tendency with the best of care to injure the dura or even the brain-tissue is known to all. It destroys the vitality of the button of bone, and makes an opening restricted to the fixed diameter of the trephine in hand. It is tiresome, dirty and practically abandoned by the advanced cranial surgeons.

The Stalwagen trephine is a considerable improvement, but it is still possessed of many of the defects of the original trephine. It is very tiring to the hand and is easily capable of injuring the dura and causing serious hæmorrhage. It does not permit of a bevel edge and the sustaining shelf so desirable. There is a tendency to jam consequent upon and

inseparable from its mechanical construction. This jamming is intensified as the cut becomes deeper. Subsequent enlargment of the original opening must be made with the bone forceps, with a resultant waste of bone.

The mallet and chisel are probably used by more of the best surgeons to-day than any other instruments. Yet after all such weapons are a shock to us, more to the laity and most to the unfortunate victim requiring its use. The charge has some merit that more perfect instruments should have been devised long ago. Yet we are aware that the mallet and chisel have many elements of superiority. They permit of sections of any desired shape and size, and they permit of reposition of the bone-flap upon supporting spicules of the surrounding bone, giving results possibly attained by no other instrument heretofore used. The objections to the chisel are the length of time required to make the bone-flap, the concussion that undoubtedly does add to the risks of the patient, and the great likelihood of the bone suddenly giving away and the skull contents being injured. The difficulties of the mallet and chisel increase many fold with an unusually thick or hard skull. While a surgeon with much practice may become high-master in the use of the mallet and chisel, yet all appreciate that its use generally is fraught with many perils.

The foregoing instruments have the advantage of cheapness and that they are dependent upon no mechanism restricting the wide range of their usefulness.

The Cryer instrument, devised by Dr. Cryer of this city, is a departure from the principles of its predecessors. It receives its cutting power from a mechanical source external to the operator. A side-cutting drill is used to make the section in the bone, and an inside guard is provided that protects the dura from all possible injury. The flap section is made large or small at the will of the operator. Celerity is attained, hæmorrhage is avoided, and a vital flap is secured. Some of its disadvantages are that it makes a wide incision of the bone, not permitting the shelf support so

desirable. The drill is necessarily slender, to make a reasonably narrow incision. Inasmuch as the force is applied against the long diameter of the drill, the point of least resistance, the drill must not be pressed too hard against the bone or it will break.

The inside guard prevents the instrument being withdrawn till it is carried back to the original opening. This may present a very considerable disadvantage under certain circumstances. The operator's hand must constantly occupy a constrained position in keeping the guard up against the inner wall of the skull.

An instrument devised by Alfred Sykes, of Yorkshire, is a modification of the Cryer instrument having a handle at right angles to the drill-shaft. This instrument, of which I have seen the illustration only, possibly relieves this uncomfortable position of the hand, though I would not judge it as useful as the Cryer instrument in other respects.

While the Cryer instrument can be sterilized, its structural parts cannot be dissociated by an amateur for thorough cleansing purposes.

The Doyen saw utilizes the circular saw but without an efficient guard to adequately control the depth of cut. Its construction does not permit that steadiness and fine control which is an essential in this class of instruments. I am informed by Prof. Keen that as he saw it used it was no more rapid than he found possible with his mallet and chisel.

The Doyen small saw is a Hey saw with the addition of an adjustable guard. It is subject still to practically all the disadvantages of the Hey Saw.

In the Sudeck instrument the circular saw is placed between the handles. The instrument is grasped as a woman would grasp the handles of a rolling-pin. It does not have an adjustable guard. While by no means devoid of merit, yet its construction prevents the utilization of many of the principles which are necessary to make a thoroughly practical saw. The defects of the foregoing instruments are apparently overcome by my new saw.

The osteoplastic flap can be made any size or shape.

The time required to make the cut is as short as can possibly be hoped for.

When using the outside guard, it is impossible to cut deeper than the depth set by the guard.

The likelihood of hæmorrhage, particularly with the use of the inside guard, is obviated.

The incision is but one millimeter in width, whatever the thickness of the skull.

Perfect bony support for the reposed flap is secured to a degree not heretofore obtained, giving perfect bone protection to the brain.

The instrument gives no vibration, a thoroughly comfortable grasp to the hand, and occasions no tension of the hand, permitting a full utilization of the sense of touch.

The inside guard, when used, can be detached immediately and the saw at once withdrawn from the cut.

The saw is so simply constructed that by observing a few simple rules no mishap in its working should occur. Further the construction is so simple that a nurse or a amateur can take it apart and cleanse it thoroughly, replacing the parts without trouble.

It will no doubt take time for the profession to accustom itself to this new instrument, but I firmly believe that a utilization of the principles here involved will open up a new field in successful and more perfect surgery of the brain.

ON THE USE OF THE TEMPORAL FASCIA TO COVER IN CRANIAL DEFECTS.*

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AMONG the manifold methods in use for covering over defects of the cranium, the osteoplastic, employing a living bone-flap, as advised by Mueller and Koenig, is the one most commonly selected. Only in cases where the execution meets such technical difficulties as insufficiency of diploe or excessive thinness of the surrounding material, would one fall back upon one of the various heteroplastic procedures. In these subsequent remarks may it be permitted me to point to another possible method of bridging over the defect. This is not a technical improvement over those most excellent methods already mentioned, but at the same time it meets an indication in lacerated wounds which they do not, viz., the question of adhesions after cicatrization. And indeed this point is of decisive import. Jackson, as is well known, noticed that cerebral epilepsy can be caused by minor tissue changes, especially scars. The recognition of this etiological fact nurtured the thought of removing parts of the scar, or similar changes. Several operators have actually been successful in achieving results in this hitherto unfertile field.

The report of Graf[1] comprises 92 cases of Jacksonian epilepsy, in 82 of which tissue changes had taken place. These involved either the brain, the membranes of the

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* Read before the German Medical Society of New York, April 30, 1906, with presentation of patient.

[1] Operative Behandlung der Epilepsie, Arbeiten aus der chirurgischen Klinik der K. Universitaet, Berlin, 1898, Thl. 13.

brain, or the skull itself. Seventy-one cases in all were operated upon; 4 died, 20 remained unimproved, but 22 were completely cured. Furthermore it appears that 23 cases which had been observed for too short a time to justify a final verdict became well. For it is often the case that the attacks vanish for a space of time, due perhaps to transient traumatic irritations, and then recur later on with renewed or aggravated violence.

The best surety for permanent cure seems to me to prevent firm reunion after extirpation of the cicatrix. The apposition of periosteum and brain must necessarily cause more or less unyielding scars. A plastic transposition of the dura can only be thought of in small defects. Therefore I sought a material which shows no marked tendency toward adhesion, and believe I have found it in the strong fibrous sheath presented by the temporal fascia. We know that in operations upon aponeuroses, union takes place with the surrounding structures through loose, wide-meshed, web-like connective tissue. When we fold over the flap gained from the temporal muscle and periosteum, then the brain is covered by fascia, the periosteum remaining on top. Slowly a protecting lid is formed which gives ample protection even though it does not attain the thickness of a bone-flap. In this wise the question of cover and adhesion is considered at one and the same time. In the following case the theoretical reflection has been borne out in practice.

The patient, 41 years old, had been well until he fell from a height of 20 feet on May 6, 1904. He landed on stony ground and in an unconscious state was carried off to a hospital where he lay in a comatose condition for eleven days.

As far as I can find out, the diagnosis of fracture of the skull had been made, and several bone-splinters had been removed on the day of the injury. Twelve days later the wound had healed and the patient was allowed to go home. He was treated there by his family physician Dr. W. A. Goodall, from whose report I gather that the right arm and leg showed slight signs of paralysis during the first three weeks after his discharge

from the hospital. These gradually grew better until, six weeks after the injury, epileptic attacks set in. These came on without the usual aura. Patient suddenly became unconscious, the fingers, arms, and then the legs began to tremble. Gradually relaxation set in and patient slowly awoke from his senseless state. During these attacks, which lasted from three minutes to three hours, the pupils failed to react. There was also a marked psychical change in patient. Memory had grown weaker; formerly good-natured, he became morose and easily irritated. Patient's wife declares that his intelligence has suffered. There seems to have been no injury to the substance of the brain. Alcohol is no longer well borne, as the use of same causes congestion.

In September, 1905, I had the first opportunity of seeing the patient. At the time I found an elliptical defect, about three inches long and one inch wide at its greatest diameter, which reached from the summit of the left frontal bone to the temporal. Compare with skiagraph Fig. 4, which shows the shape of defect slightly enlarged. The gap was very large and showed distinct pulsation. No bone substance could be found in the groove.

It appears as though the skin had grown directly onto the cerebrum. A skiagraph, taken a short while later, confirmed the total absence of bone-substance.

In order to create a protection for the gap and also to prevent the formation of adhesions, I proposed an osteoplastic operation to the patient. He consented very much later after having undertaken numerous consultatory travels. Three months ago he entered the Post-Graduate Hospital where Prof. Hammond was kind enough to subject him to a neurological examination. He agreed with me in the belief that we had to deal with a case of Jacksonian epilepsy. Operation seemed especially indicated as the attacks had lately become not only more violent, but the disturbances in the function of the senses had also progressed.

On February 8th I laid bare the defect with an incision which passed around the gap in a wide circle. Slowly working my way along from the side I divided the scar tissue, holding the cutting edge of the knife toward the skin so as not to injure the brain. Then I found that the dura had remained intact

FIG. 1.—Flap of temporal fascia being raised adjacent to cranial defect.

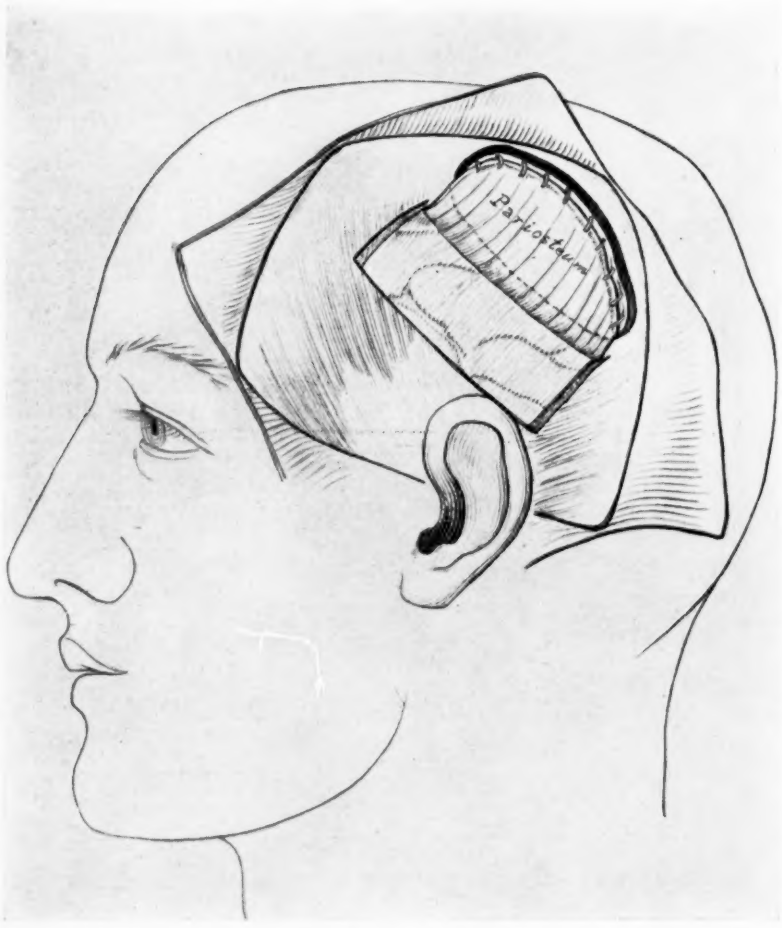

FIG. 2.—Flap of temporal fascia reflected so as to cover brain surface exposed by cranial defect.

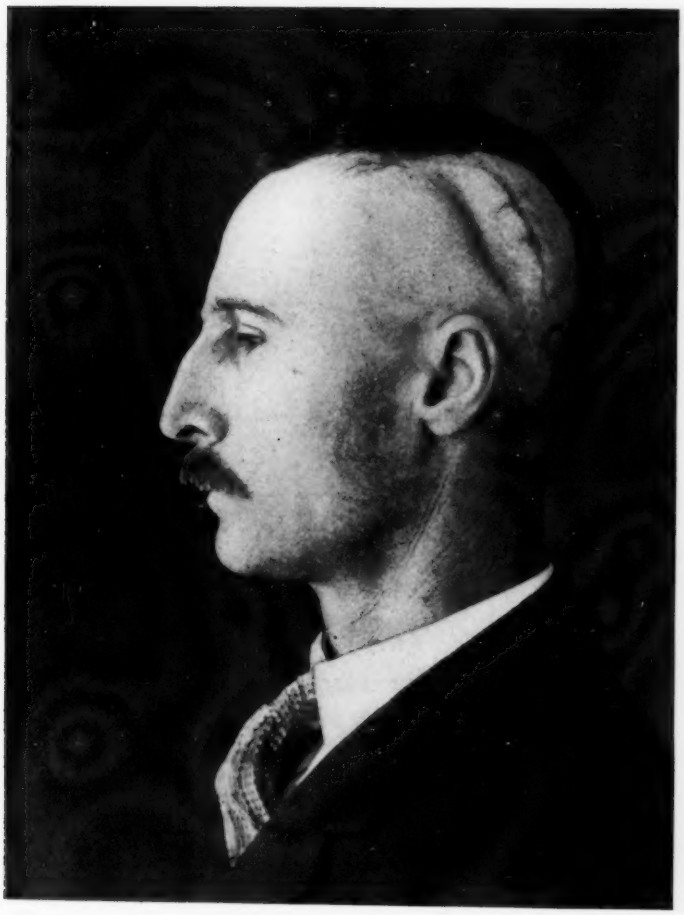

FIG. 3.—Showing appearance of patient three months after plastic operation to close cranial defect.

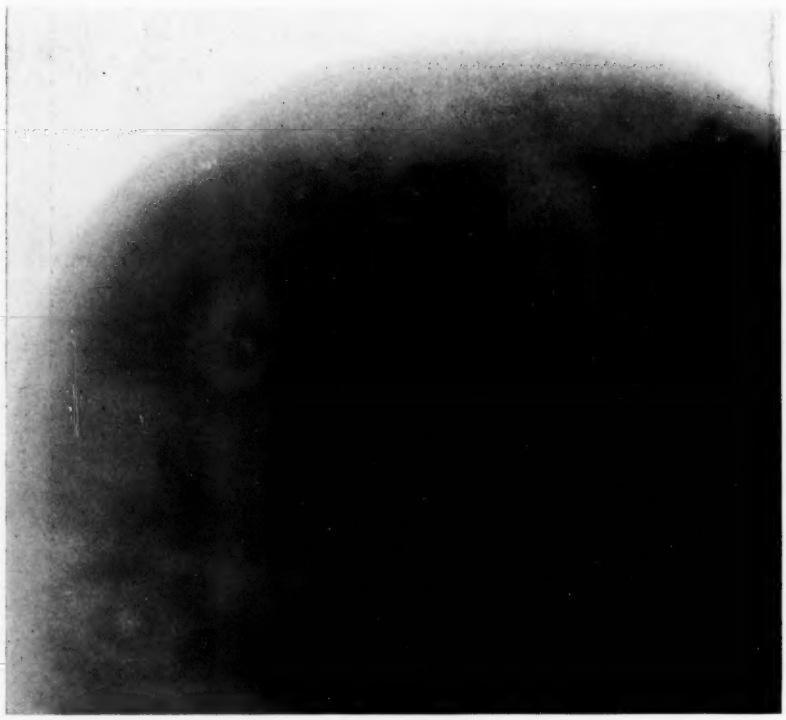

FIG. 4.—Showing bone proliferation in the lower two-thirds of the defect three months after plastic operation.

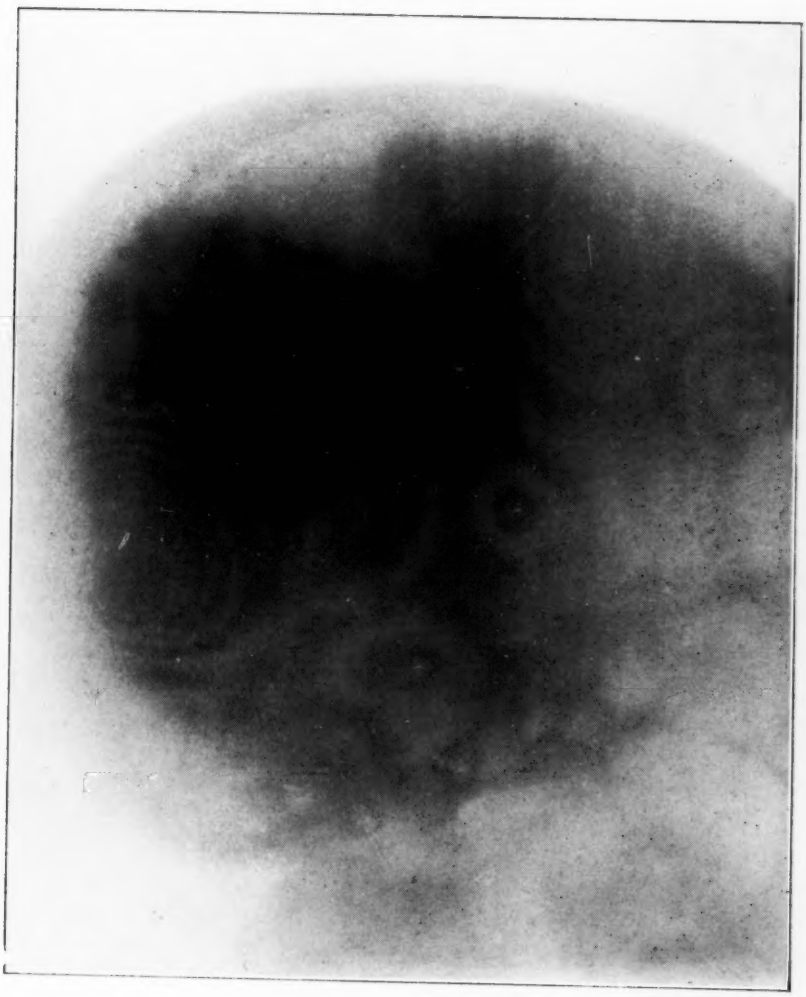

FIG. 5.

only along the edge of the defect. As the skiagraph had shown, small stalactite-like projections had formed at different spots along the edge. These were removed by scissors and bone-shears. During this manipulation a small cyst which had formed under one of these protrusions was emptied of its greenish-yellow contents.

Now, if, as apparent, the pressure-symptoms were principally the result of the extensive scar-formation, then it was necessary to employ a method in covering the defect, which excluded such dense adhesions as had formed. As already mentioned I believed the needed material would be found in the temporal fascia. I commenced the procedure by carrying an incision around the muscle down to the bone. Then I loosened the flap with the periosteum, taking great care not to tear the connecting link of periosteum which was kept as close to the bone suture as possible. (Fig. 1.) Although the periosteum was firmly adherent there it was but loosely attached to the rest of the bone and might easily have been torn off, a condition which might have ruined the whole procedure.

I folded over the entire flap at the lower edge of the defect and covered the gap with it. At the opposite end I chiselled off enough bone to enable me to make use of a small amount of dura to which I attached the aponeurotic end with thin catgut sutures. (Fig. 2.) The aponeurosis then lies in direct contact with the brain, with the periosteum on top. The skin surfaces were united. The wound healed primarily. The general health of the patient has improved and he feels normal in every way. Up to date he has had no convulsion.

I am well aware of the fact that the period of observation has been too short to make a pass verdict concerning the convulsions, and I will report concerning them again later on.

As far as the plastic operation is concerned, a decided success has been gained. Although the operation enlarged the defect somewhat by the removal of bone, the defect at present shows a smaller gap than before (Fig. 3). The latter is not as large as before operation. If we palpate the groove we can plainly demonstrate the bone which has formed from the periosteum. The same is visible on the

skiagraph (Fig. 4) as a faint cloud. Of course the lid is not as solid as a bone-flap would make it. But is this absolutely a necessity, and does not this light covering perhaps render the same service? The utilization of aponeuroses in the place of muscle-tissue might also prove of value in such cases in which we desire to prevent reunion by insertion between bone fragments (as anchylosis, etc.).

Since making this report I have had another opportunity of performing the same operation on a boy of thirteen years, who fell out of a window a year ago and sustained a compound fracture of the skull. I am informed that he vomited considerably during the first twenty-four hours, was paralyzed, but able to talk. Ever since he showed symptoms of Jacksonian epilepsy. May 13, I exposed the defect the size of which exceeded somewhat that of a silver dollar, at the St. Mark's Hospital. There were dense adhesions between skin, dura and arachnoid, which were divided. The defect was situated on the left parietal bone. As it extended nearly up to the top of the skull, it required a long flap to reach it. There was no reaction after the operation, the patient being well at the present writing (two weeks after the operation).

ACUTE SEPTIC INFECTION OF THE THROAT AND NECK; LUDWIG'S ANGINA.

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THE acute septic infection which involves the mouth, throat, neck, submandibular and parotid regions, known clinically as Ludwig's angina, is as yet not thoroughly understood as regards its pathology, nor is its treatment efficient. It is an extremely fatal disease, and in many instances probably unnecessarily so. The modern exact methods of observation, record and research should be applied to it, so that the affection can be recognized and its treatment placed on a proper scientific basis. Septic inflammations of the neck were more or less well known before 1836, but in February of that year D. Ludwig, of Stuttgart,[1] described what has since been known as Ludwig's angina. He stated that it was fatal in almost all cases. It began with slight fever, chills, headache, disturbed appetite, coated tongue, and often difficulty in swallowing. Usually on one side of the neck affecting the cellular tissue in the region of the submaxillary gland, rarely the sublingual or parotid, a hard swelling appeared. It spreads under the chin around the neck to the opposite side, over the larynx and perhaps the parotid. The sublingual region is infiltrated and the tongue rests on a hard base. It is both painful and difficult to open the mouth. Speech is impaired and partly from pressure on the larynx and partly on account of invo vement of the smaller neck muscles the voice is rough and guttural. Mucus, which is difficult to expectorate, accumulates in the throat.

Early in the disease, during the first four or six days, the skin is not red and the constitution not much affected. Later openings occur posteriorly on the inside of the mouth, and a thin gray or red brown evil-smelling liquid exudes.

A gangrenous odor develops, the lungs become affected and death ensues in ten or twelve days. On post-mortem examination the cellular tissue and muscles around and under the jaw and the posterior portion of the throat are found to be gangrenous.

This description of Ludwig is typical of the severer forms of the affection, and it was henceforward known as Ludwig's angina.

In 1895, however, Felix Semon[2] of St. Thomas' Hospital, London, in a paper before the Medico-Chirurgical Society, claimed that the various affections hitherto described as acute œdema of the larynx, œdematous laryngitis, erysipelas of the pharynx and larynx, phlegmon of the pharynx and larynx and angina ludovici were simply various forms of acute septic inflammation of the throat and neck and pathologically identical; also that they merely represented degrees varying in virulence of one and the same process, and that the question of their primary location and subsequent development depends in all probability upon accidental breaches of the protecting surface through which the pathogenic micro-organism finds entrance; and that it is absolutely impossible to draw at any point a definite line of demarcation between the purely local and the more complicated, or between the œdematous and the suppurative forms. His views have been more or less accepted by probably the greater number of writers on the subject.

Before a disease can be said to be mastered we must understand its pathology and therefrom deduce a rational method of treatment. Any method of treatment not based on the pathology of an affection must be more or less empirical and therefore to a considerable extent unreliable and uncertain. For this reason a knowledge of the pathology of a disease is the first step toward efficient treatment. Ludwig recognized that the disease was one of septic infection, but in his day, 1836, bacteriology was practically unknown, and he was limited in his knowledge to clinical observation and gross post-mortem examination. We

should know (1) what is the germ or germs that start the infection; (2) how do they gain access to the tissues; (3) what tissues are attacked; (4) how the infection progresses; (5) how it influences the parts locally and, finally, (6) how it affects the system generally. Our knowledge is so incomplete that partial answers only can be given to these questions.

1. What is the germ or germs that start the infection?

Inflammations of the throat can be produced by mechanical and chemical irritants, as by injuries and poisons and œdema occurs in Bright's disease, but these are not due to infection and as a rule do not resemble the latter either in their clinical appearance or course. As regards the character of the infection we are still considerably in the dark. In almost all cases germs are readily detected, but their exact nature and action are to a great extent unknown. In some cases pure cultures of a single micro-organism are found while in others so many are present that it has been found to be impossible to identify them. Even when only one or two kinds are found it is not proof that others were not present likewise. Mixed infections are common. If crepitation is present in the tissues it is assumed that a gas-producing bacillus is its cause, and while it may be found it will probably be accompanied by other organisms. Fetor is likewise attributed to a bacillus, but this is not so certain as in the case of gas. Fetor is a common accompaniment of severe cases, yet the presence of bacilli is comparatively rarely recorded. Another disturbing element is the known fact that certain organisms act very differently, according to the tissues in which they develop. The pneumococcus in the lung may produce a lobar pneumonia which is quite different from the infectious conditions of the neck in which it may be the only demonstrable organism. The streptococcus of cutaneous erysipelas seems to act in an entirely different manner from the same organism in the deep tissues of the neck.

In twelve cases in which the character of the infection

is noted the following organisms were found: Case 1, streptococcus; 2, staphylococcus and pneumococcus in the mouth and streptococcus in the pus; 3, pure streptococcus; 4, Eberth's bacillus in the spleen and pure streptococcus in the tissues; 5, pneumococcus and some streptococcus; 6, streptococcus; 7, staphylococcus albus and aureus; 8, pneumococcus; 9, streptococcus; 10, large bacillus and staphylococcus aureus and pyogenes; 11, some bacilli, diplococci and streptococci; 12, staphylococci, streptococci and some non-identified organisms.

We thus see that in Cases 1, 2, 3, 4, 6 and 9 streptococcus in the pus and tissues was the sole organism detected. In Case 8, pneumococcus alone was found. In Case 7, staphylococcus alone was found. So that it appears that the same clinical affection can be produced by at least three different organisms. Continuing, we find in some cases the pneumococcus associated with streptococcus (Case 5), with staphylococcus (Case 2), and with streptococcus and some bacilli in Case 11. In Case 12, staphylococcus is found associated with streptococcus and other non-identified organisms. All of which tends to show that these septic neck infections may arise either from a single, but not always the same, variety of organism, or may be a mixed infection of so great complexity as to be impossible of exact identification. Lockwood[3] who gave considerable study to the question of infection states that Ludwig's angina is probably a mixed infection of the most complex kind. That this is so is true in some cases, but in many only a single organism, usually streptococcus or pneumococcus, has been found even in typical cases. From these facts we must conclude that the septic infections of the neck which include those classed as Ludwig's angina can be caused either by one of several organisms, as the staphylococcus, streptococcus and pneumococcus, or by a mixture of various forms, including a gas-producing bacillus.

2. How do the infecting organisms gain access to the tissues?

In many cases the mode of access is unknown, but it is practically established that the infection starts from some lesion in the mouth or throat. Most often it starts from the teeth. In many cases trouble with the teeth antedates or coincides with the onset of the infection. In some cases (as in Case III.) the infection follows so rapidly as to leave no doubt as to the causal relation. As pointed out by Semon the infection does not usually involve the nasal cavities. C. J. Aldrich[4] describes a case that almost certainly started from the tonsil, and this organ has been frequently found involved and another[5] following a pin scratch of the frænum. He also suggests that the infection involves the salivary glands by being transmitted along their ducts. W. O. Humphrey[6] also describes a case preceded by tonsilitis. A case by C. M. Harris[7] suggests an inflammation of the middle ear as being a starting point. The question of mode of origin may be an extremely important one, particularly to dentists. In one of my cases (Case III.) a young lady had an abscess on a lower molar tooth. She went to a dentist who injected a solution of cocaine around the tooth and extracted it. Swelling followed almost immediately and soon assumed the character of Ludwig's angina. It was incised on the fourth day, recovery following. In this case the dentist was accused of having started the inflammation by the use of infected solution or instruments. He stated this was not the fact, as he had used all possible antiseptic precautions. In such a case it is practically impossible for a dentist to demonstrate his innocence. The frequency of infection following trouble with the teeth is such that when a high grade of inflammation exists and an abscess may be forming or already formed dentists will neither extract the offending tooth, nor open the abscess, nor attempt any operative means of relief for fear they should be held accountable for subsequent results.

3. What tissues are attacked?

It is evident that the parts attacked will depend to a certain extent on the location of the breach or injury at

which the infection entered. Semon cites many cases in which the focus of the inflammation involved the tonsil, epiglottis and larynx. In some instances the discharge breaks into the larynx. Œdema of the glottis not infrequently necessitates tracheotomy and may lead to death. When the teeth are the starting point the inflammation involves the periosteum of the lower jaw and thence invades all the surrounding tissues. In many instances (as in Case VI.) the exact point of commencement is unknown and attention is first attracted by the swelling of the tissues of the floor of the mouth and beneath the jaw. While the point at which the infection starts localizes the disease at its commencement, it progressively spreads and involves all the tissues within its scope. No matter how it commences, it spreads along the connective tissues by direct continuity. It is not transmitted by the lymphatics. The lymphatic glands do not become enlarged by infection carried to them by the lymph-stream from the infectious focus, but they are involved in the infected connective tissue surrounding them. In many cases the deep tissues are markedly involved causing a peculiar "wood-like" induration and yet there may be but little or no redness of the skin. This is particularly true early in the course of the disease. As it progresses all the tissues become affected. The bone becomes bare and the soft parts become gangrenous. It is a gangrene of the deep-lying connective tissues and the muscles within them. The process seems to experience difficulty in piercing the deep fascia, hence the skin and subcutaneous tissue are often but little affected. Commonly, particularly early in the disease, there is but little tendency to the formation of pus, and when the epiglottis and larynx are involved, œdema supervenes and causes suffocative symptoms. Early incisions often give exit only to serum and no pus is found. It usually makes its appearance later and is dark colored and peculiarly offensive.

4. How the infection progresses.

As already stated it progresses by direct contiguity of

tissues. Sometimes it begins on one side below and behind the angle of the jaw and passes directly across to the opposite. At other times it passes downward on the neck as far as the clavicles and sternum (Case V.). If it is inside, it soon involves the larynx and tissues around the œsophagus and difficulty in swallowing and breathing may be early symptoms. In fatal cases it follows the cervical tissues down the neck and into the mediastinum and produces a septic pneumonia. The progress of the disease is comparatively acute, often running its course in six to twelve days. It may stop at any time, or it may progressively increase until death is caused by septic infection. In laryngeal cases, death may occur early from suffocation.

5. How it influences the parts locally.

This has already been detailed to a considerable extent. Swelling is the first sign. It shows itself under or behind the lower jaw, in the floor of the mouth, pushing the tongue toward the roof, or in the larynx and epiglottis in the form of œdema. The skin often is normal in color, especially early in the affections and there may be no tendency to the formation of abscesses. In infections from pyogenic organisms, the skin becomes red and rarely considerable collections of pus may occur. It is frequent for openings to occur alongside of the teeth posteriorly and foul, ichorous, pus to exude into the mouth. Later the tissues become gangrenous and may come away as sloughs if the patient survives. If the disease tends to recovery, the local conditions improve with great rapidity, and usually leave no serious results.

6.—How is the system affected?

The affection is primarily a local one, and the general system only becomes involved later. The fever for several days may be moderate, about 101°, but later when sepsis is marked rises to 105° or 106°. These very high temperatures are exceptional. Especially when the streptococcus is the prevailing infecting organism the temperature may not rise above 101° or 102°, even though the case is tending to a fatal issue. In cases of mixed infections the presence of

pyogenic organisms (staphylococci, etc.), may cause the temperature to run higher. At the commencement there is practically no systemic depression but in a few days it becomes marked and deepens to the end. Death may occur either comparatively early from suffocation or heart failure, or later from exhaustion and sepsis. When the disease attacks the larynx death may occur suddenly and before the supervention of marked septic depression. Whether these deaths are due to suffocation or heart failure caused partly by sepsis and partly by the impeded respiration is sometimes difficult to say.

In one case (Lombard et Caboche[8]) a patient who had had great difficulty in breathing was talking with his wife when on reaching for his handkerchief he suddenly fell over and quickly expired. Case No. IX. died in almost the same manner.

In Robertson and Biedert's[9] case sudden death occurred after a tracheotomy had been performed, so that suffocation could not have been the cause. In one of Ross'[10] cases likewise sudden death resulted while the opening existing through the larynx was sufficient to preclude respiratory obstruction.

In Case VIII. the dyspnœa was so great as to require tracheotomy and the patient died on the table. These sudden deaths occur usually in patients in which the epiglottis and larynx are affected and the dyspnœa marked. Involvement of the larynx is indicated by the diminution and loss of voice and difficulty in respiration.

The question of the affection being epidemic has been suggested by Seymour Taylor,[11] who saw a series of cases in the Hammersmith district. F. Murchison[12] and Klein[13] also refer to an outbreak in the Hebrides. Klein states that it is not contagious as there were never two cases in the same family. Five of my own cases came from a single section of the city in a period of five weeks. Thus it is seen that while it can hardly be said to occur in epidemics like the infectious fevers, still it does occur sometimes

in groups, and more frequently than at others, as is the case with that other streptococcus-infectious disease, cutaneous erysipelas.

The question of its infectious character is likewise of importance.

Two of my cases resembled erysipelas so much that they were isolated. In fact it would be best if all these cases were isolated. In most instances it is largely a streptococcus infection and acts like erysipelas. Even the cases that show pneumococcus and staphylococcus infection act clinically much like the others and seem to be but little less virulent. Some have been inclined to regard the disease as being a true erysipelas, but this term could hardly be applied to those cases showing only staphylococci or pneumococci. The disease also acts at times like a common pyogenic affection, all signs ameliorating as soon as an incision is made and tension relieved. Would anyone expect a cutaneous erysipelas to act so? It suggests the possibility of curing the latter disease at once by making free incisions into the affected area.

Another character of the disease is that it sometimes shows a tendency to again extend after apparently convalescing. This occurred in three of my cases and in Dr. Ross' case death occurred suddenly two weeks after the case was reported, and the autopsy showed ulceration of the larynx.

Diagnosis.—The question of diagnosis is intimately associated with that of treatment. It is one not so much of character as it is of degree, but even the question of character may be obscure. Many practitioners have never seen nor recognized a bad case of the so-called Ludwig's angina; as a consequence, in its early stages particularly, it is apt to be unrecognized and energetic treatment deferred until too late. Statistics are practically useless. A septic infection is dangerous according to its extent, and these infections occur in all grades. If mild cases are seen the mortality is slight and if serious cases are seen the

mortality is high. In the ten cases here recorded four died, a mortality of 40 per cent. It must be borne in mind, however, that many light cases which recover are not considered to be of the kind we are now discussing. In making a diagnosis of inflammatory and œdematous affections of the throat and neck, it should be borne in mind that one class of cases as already stated is local in character and usually remain local and do not show the same tendency to spread through the medium of the connective tissues as do the other. Those arising from mechanical and chemical irritants, from interference of the blood-supply producing œdema; from surface inflammations as glossitis, stomatitis, pharyngitis, laryngitis; from inflammations of neighboring organs as the tonsils, salivary and lymphatic glands, syphilitic and tuberculous ulcerations may all be confounded with acute septic infection. In some cases it is impossible to draw the distinguishing line particularly in the early stages, yet it is essential that the true character be recognized as soon as possible, because one class tends to pursue a comparatively benign course while the other pursues a decidedly dangerous one.

The onset of the affection is often insidious, yet some cases are fulminating. That of Biedert and Robertson completed its fatal course in ten hours.

The disease produces local signs before general symptoms, and attention may first be attracted by a swelling which may be either below the jaw in the submaxillary region or posteriorly over the parotid region. The hard "board-like" character of the swelling is almost pathognomonic. Sometimes the skin is pale, sensitiveness not marked, and the temperature raised but one or two degrees. In other cases the skin may be a dusky red, tender, hard and painful to the touch, and the temperature high, 102° or 103°. Swelling of the floor of the mouth pushing the tongue upward to the roof and forward, with difficulty in swallowing and some difficulty in breathing, are early noticed. Chills may occur and dirty offensive pus may

break into the mouth near the molar teeth. The swelling may extend down to the clavicle and up on the temple and a large abscess may form beneath the lower jaw. The temperature rises and death from sepsis follows usually inside of twelve days. Death may occur early from involvement of the larynx, this involvement being indicated first by a hoarseness of the voice and then by its loss. The progressive involvement of the deeper tissues should settle at once the question of diagnosis.

Treatment.—I am firmly convinced that the disease in its early stage is a purely local affection whose extension can be promptly cut short by fearless surgical treatment. Procrastination and timidity as well as a failure to recognize the dangers of delay, are the undoubted causes of the loss of many cases. Fears of unnecessarily scarring the patient or of encountering alarming hæmorrhage both suggest delay. He who waits for the formation of pus before incising waits too long. When a case presents itself with a hard board-like swelling beneath the jaw it is evidence of probable cellular-tissue infection. Administer primary anæsthesia with ethyl chloride, ether or chloroform, and make an incision in the median line between the symphysis and the hyoid bone and carry it through all the tissues; better all the way into the mouth, at least until the point of the knife can be recognized by the finger inside the mouth beneath the tongue. This incision is easily made, devoid of danger, is accompanied by no hæmorrhage, and drains effectively the infected area. If it is made early no pus will be found but only blood, or a little thin serum. The relief, however, is immediate. If the swelling is more toward the angle of the jaw, or in the parotid region, then incise the skin and with a pair of hæmostatic forceps bore slowly into the swollen tissues, expanding the blades and if necessary inserting drainage tubes. In very bad cases the larger the incisions the better, and one or two of my own could probably have been saved had this been done instead of relying on drainage tubes. In this affection pus does not often show a ten-

dency to accumulate, and the large incision relieves tension and allows the gangrenous tissues to be cast off.

In œdema of the epiglottis and larynx, ice and inhalations (spray) of cocaine and adrenalin may be of service, but tracheotomy should not be deferred too long. A high tracheotomy is probably just as efficient as a low one, and much less dangerous. In one of the cases here recorded death ensued on the table from hæmorrhage, and this is hardly to be wondered at when we recall the vessels which may be encountered. The large distended inferior thyroid veins, an anomalous thyroid artery, an innominate slightly more to the left than usual, or a high left innominate vein crossing above the top of the sternum, may any one of them cause a fatal issue.

CASES.

Case I.—Young woman, aged 22. Was admitted for a swelling of face and jaw. An examination of the mouth failed to reveal any cause for the infection. There was no evidence of carious teeth, tonsilitis or other focus of infection. About a week previous to admission she noticed that the side of her face was swollen, principally behind the angle of the jaw. It rapidly involved the whole neck and both sides of the face. It was slightly red, hard and somewhat painful. It had been poulticed. She could hardly swallow, the voice was altered and hoarse, the tongue swollen, and the jaws could be separated only a half inch. Temperature was 101.3°.

An incision was made in the median line beneath the chin, extending into the mouth, and another behind the angle of the jaw. No distinct pus was found but the next day very thick, offensive pus discharged. The swelling and temperature rapidly diminished and the discharge had almost ceased by the twelfth day, when her temperature rose to $100\frac{3}{5}°$ and the swelling again returned to again disappear after a few days.

An examination of the pus showed it to be a pure streptococcus infection. (See Fig. I.)

Case II.—A Russian, male, aged 26, was brought to the Episcopal Hospital with the history of having had several teeth extracted from the back part of the left lower jaw. About

FIG. 1.

four hours later the jaw became swollen and two days afterwards the right side became swollen and painful. On admission, he was unable to speak English, both jaws were swollen, breath was fœtid, and stinking pus was escaping into the mouth from the left molar region. The patient looked very ill. Tongue was coated. Urine 1026, with marked reaction of albumen. An incision below the angle of the jaw gave exit to a small quantity of foul pus. He swallowed with difficulty, his respiration became jerky and hurried, varied from 102° to 104° and once went to 106°. He died of sepsis nine days after admission.

The color of the skin in this case was pale rather than red, and at no time was there marked evidences of any accumulation of pus. It is barely possible that more free incisions would have benefited this case.

Case III.—A young woman, aged 24 years, had a lower right molar tooth extracted for an abscess of its roots. The dentist injected cocaine into the gums. Within an hour after the extraction the cheek began to swell. On the next day cold was applied and a mouth-wash used. The day following she was somewhat better, but on the fourth day the swelling got worse and the pain increased. Leeches and ice were applied but on the day following the swelling extended from ear to ear around under the jaw; it was tender, a little red and quite brawny, and hard to the touch.

An incision was made between the hyoid bone and the symphysis, extending to the mucous membrane of the mouth just below the tongue. No pus was obtained.

During the night the patient had considerable difficulty in breathing, but in the morning a free discharge of pus made its appearance and immediate relief followed.

In six days after incision the discharge of pus ceased and she was practically well. Her temperature during the attack ranged from 101° to 102.8°.

The dentist stated that he used a fresh solution of cocaine and sterilized instruments in injecting it.

The immediate following of the inflammation after

the extraction looks like cause and effect and the course after incision demonstrates its efficacy.

Case. IV.—A young man, aged 19; had, two weeks prior to admission, pain in the teeth and swelling of the jaw. The last molar on the affected side was decayed. The swelling began at angle of the jaw. He could hardly open his mouth. Urine Sp. Gr. 1027; trace of albumen; no sugar; no casts. Temperature 104.6°. An incision was made below the angle of the left side of the jaw and considerable pus was evacuated. About two weeks later the left side again became swollen, his temperature rose and he looked ill. The swelling was red and indurated and the breath foul. A small amount of pus escaped from the original incision. The symptoms gradually abated and in six days he was discharged cured.

It will be observed that this patient also had a relightening up of the trouble after the subsidence of the first attack.

Case V.—A young man, aged 20; had for some time a bad tooth in the right side of the lower jaw. Eighteen days prior to admission the right side of the neck began to swell and on admission the neck was enormously swollen extending from the zygoma above to the clavicle below, and from the right ear around the neck to beyond the median line. Voice hoarse; could not breathe lying down, and had marked difficulty in swallowing. His temperature was 101°, pulse, 120, respirations 24. General condition, good.

Two incisions were made, one in the median line and the other beneath the angle of the jaw. Practically no pus was obtained. He had to sit up all night, but his dyspnœa gradually disappeared. Two days later there was a small amount of pus, which showed streptococcic infection.

On the fifth day his temperature was normal and on the tenth day he was discharged with the wounds not yet closed.

Another example of the efficacy of free incisions and deep exploration with a hæmostatic forceps. (See Fig. II).

Case VI.—A man, aged 23 years, was admitted to the hospital for typhoid fever, having been ill two weeks. Seven days after entrance while feeling much better it was noticed in the

FIG. 2.

FIG. 3.

morning that his face looked fat. By three o'clock in the afternoon the neck was swollen, hard and tender in the submental region. He could only open his mouth half way. Leucocytosis of 12000. No growth on the tonsils. The next day swelling was more marked and indurated nearly to the sternum. He was beginning to have difficulty in respiration. An incision was made through the swollen parts between the symphysis and hyoid bone, extending through into the mouth. A considerable amount of thin brownish-green discharge escaped. Cultures of streptococci, staphylococci and pneumococci were obtained from the mouth and streptococci and staphylococci from the wound discharge. The day following the wound was discharging pus freely and pus was also discharging from the right ear. The next day he was still better but the following day the neck again swelled, became red and looked like erysipelas. He then passed through a regular attack of cutaneous erysipelas, which lasted three weeks. It spread up over the left side of the face and closed the left eye. Then the wound healed but the right side of the face began swelling, involving the left eyelids. An abscess formed in the left eyelid and discharged gray pus. An abscess formed in the left molar region and was opened, and the left ear also discharged pus. The erysipelas finally disappeared and the patient recovered. (See Fig. III.)

This was a case of mixed infection. The erysipelas was a typical attack and I regard it as not being a new infection from without but a direct extension by continuity of tissue of the streptococcus infection which began in the submental region. A case like this goes far to prove that the original infection was much the same as occurs in ordinary erysipelas. This is the third case in the series in which a subsidence of the original attack was followed by a secondary outbreak.

CASE VII.—A man aged 48 years had been attending the outpatient department of St. Joseph's Hospital for an infected wound of the finger. He was absent for some time and was returned to the hospital in such a septic and depressed state that no history could be obtained. The left side of his face in the parotid region and behind the angle of the jaw was hard

and swollen but not very red; œdematous and tender on pressure.

The mouth was partly open, tongue coated, teeth in bad condition and a foul discharge of pus along the posterior portion of the left lower molar teeth. The index-finger of the right hand contained a small quantity of pus. Heart and lungs negative. Urine 1020, acid; albumen 4 per cent. ; no sugar.

Temperature on admission 98.6°; next day it went to 106.4°. It varied between these extremes with chills until he died on the sixth day after admission. The swelling invaded the temporal region and rales appeared in the lungs and then he died from sepsis. He was treated by incisions and a large drainage-tube from the angle of the jaw into the mouth.

This case was pyæmic on admission, and it is doubtful if any treatment would have saved him; but it is probably worth while in such cases as this to make a long incision from below the ear, behind the angle of the jaw and as far forward as the swelling extends. I believe drainage by means of tubes is insufficient and wide-open incisions are required.

Case VIII.—This case I saw but did not treat. He was a man, aged 35, an engineer, who was brought into the hospital drunk. He had a swelling beneath the jaw and was transferred to the surgical wards. The swelling rapidly increased, accompanied by attacks of dyspnœa.

The mouth and throat was sprayed with a solution of cocaine, adrenalin and menthol. On the fourth day he had such a severe attack that tracheotomy was attempted but he died on the table from hæmorrhage.

When death occurs from suffocation it is usually not as in this case from an acute paroxysm but more usually by a gradual shutting off of the air until the overloaded heart simply gives out. This case illustrates the difficulties and dangers of performing tracheotomy when the neck is greatly swollen.

CASE IX.—Was admitted under the care of my colleague, Dr. Edsall. It was a man, aged 42 years. He retired one night apparently well, but was awakened the next morning being scarcely able to breathe and having a violent rigor. He could only lie a short time and then had to sit up. He felt as if there was a lump in the throat. He stated that there had been a lump on the right side of the throat, which broke and allowed a lot of foul material to run down his throat. On admission he was short of breath and had a hard mass on the left side of the neck. No fluctuation or other evidences of suppuration. Uvula much swollen and œdematous. Tonsils could not be seen. The swelling was incised but no pus was obtained. Thorough drainage by means of a tube was employed, which gave some relief. Urine 1023, acid marked, trace of albumen, no sugar. He died apparently of suffocation, suddenly, on the second day after admission and the fourth day of the disease.

Another instance of the apparent inefficiency of the drainage-tube.

CASE X.—Was under the care of my colleague, Dr. Frazier. It was that of a man, aged 61 years. A decayed loose tooth had been occasioning the patient some trouble and a week before admission he had had considerable pain in the lower jaw. A swelling began under the jaw, which was painful and very hard. He had difficulty both in breathing and swallowing.

On admission there was a hard swelling under the chin, extending down to the larynx. The breath was extremely offensive. There was redness and swelling under the tongue. The loose tooth from which the trouble originated was still in. The swelling was incised and a thin watery material oozed out, along with blood. There was no free pus. Three openings were made and two rubber tubes were put in as drains and a hæmostat was thrust in several directions and opened and drawn out. Very little thin, watery, offensive fluid escaped. Considerable of this same foul-smelling material was later seen on the dressings. Considerable relief was obtained from the operation. At one time the patient was expected to die, but eventually recovered after a stay in the hospital of nine days.

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TOTAL LARYNGECTOMY FOR CARCINOMA.

REPORT OF A RECENT SUCCESSFUL CASE.

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THE patient, C. E. W., aged 46 years, had always enjoyed good health up to the present trouble, which began two years ago, when he first noticed that he was gradually getting hoarse. He consulted his family physician, Dr. G. N. Ferris, and was under his care for about six months. At the end of that time he was referred to Drs. C. C. Rice and Ferguson, of New York, under whose care he has been since that time. In the beginning the case was regarded as a papilloma of the right vocal cord, and eight months ago it was removed by Dr. Rice, resulting in immediate restoration of the voice. In about two months, however, the hoarseness returned, and the growth was again removed; this second operation was again followed by a return of the hoarseness in about two months, and in spite of local treatment, the growth persisted. It was now apparent that it was malignant in nature, and the advisability of a more radical operation was suggested. The condition of the laryngeal involvement, when the patient came under the writer's care, is shown in the accompanying sketches (Figs. 1, 2 and 3).

After consultation with Drs. Rice and Ferguson, who gave me the foregoing history, and with Dr. P. H. Sturgis, who saw the case with me, and after looking up the literature upon the subject, particularly an article by W. W. Keen,[1] of Philadelphia, the writer advised a total laryngectomy, for the reason that the operation as described by Keen appealed to us as being by far the most rational surgical procedure to adopt in such a case; there being, as he says, but one objection, namely, the loss of voice, which we believed should not be considered in dealing with a malignant growth of the larynx. The question is not, shall the patient talk, but shall he survive the operation, and

[1] ANNALS of SURGERY, Vol. 30, 1899

the danger of recurrence be reduced to the minimum. Having explained to the patient the danger of the operation and the disability that might result therefrom, he requested that it be done. The larynx was totally removed by me on April 18, 1906, with the assistance of Dr. J. B. Bogart, at the Methodist Episcopal Hospital in Brooklyn.

The shoulders having been slightly elevated to extend the neck, the patient was placed under chloroform anæsthesia. An incision was then made, extending from the body of the hyoid bone to the episternal notch, and the larynx and trachea exposed to a point just below the cricoid cartilage; the soft parts were then dissected away from the larynx well back to the œsophagus. The hæmorrhage, which was not great and came principally from the upper border of the thyroid isthmus, was now controlled. The patient was placed in the Trendelenburg position, and the trachea divided just below the cricoid cartilage, and immediately sutured to the skin by two chromic gut sutures, one on either side.

Some coughing, which followed, was immediately controlled by the application to the tracheal mucous membrane of a solution composed of equal parts of one to one thousand adrenalin solution and 4 per cent. eucaine. The larynx was then lifted up by the finger and rapidly dissected from the œsophagus up to its upper border. The thyro-hyoid membrane, together with the other structures attaching it to the pharynx, were then divided, and the organ removed. The epiglottis, which was not involved, was spared. The upper margin of the pharynx was now attached by a double row of cat-gut sutures to the tissues just below the hyoid bone; the first row of plain cat-gut to secure approximation of the mucous membrane; the second of chromic gut to secure firm apposition of wound surfaces. The soft parts were then sutured from above downward with interrupted cat-gut sutures, and the skin by a chromic subcuticular. A drain was now brought out at the lower angle, and two more chromic gut sutures were introduced, uniting the trachea more firmly to the skin.

The entire operation lasted forty minutes, the excision itself taking twenty-five minutes. No further anæsthetic was used after the trachea was divided during the remaining fifteen minutes occupied in closing the wound, and none was necessary,

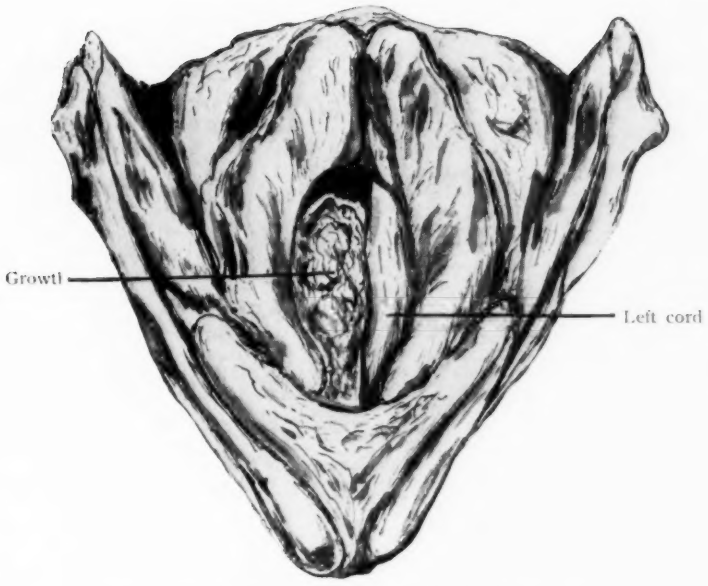

FIG. 1.—The larynx and growth as it appeared from above.

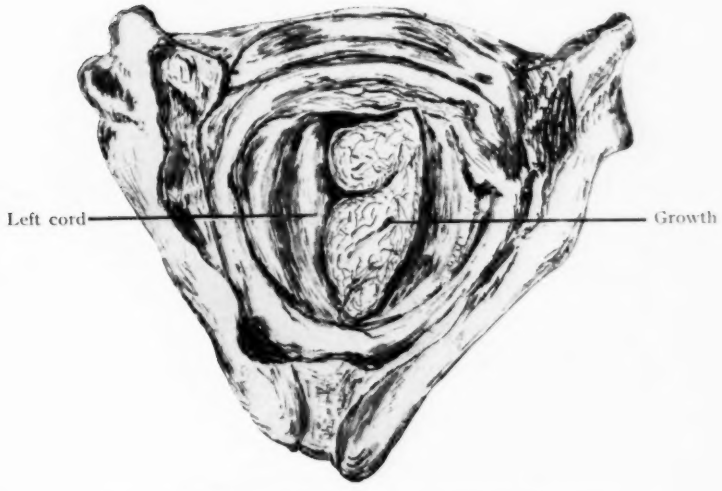

FIG. 2.—The larynx and growth as it appeared from below.

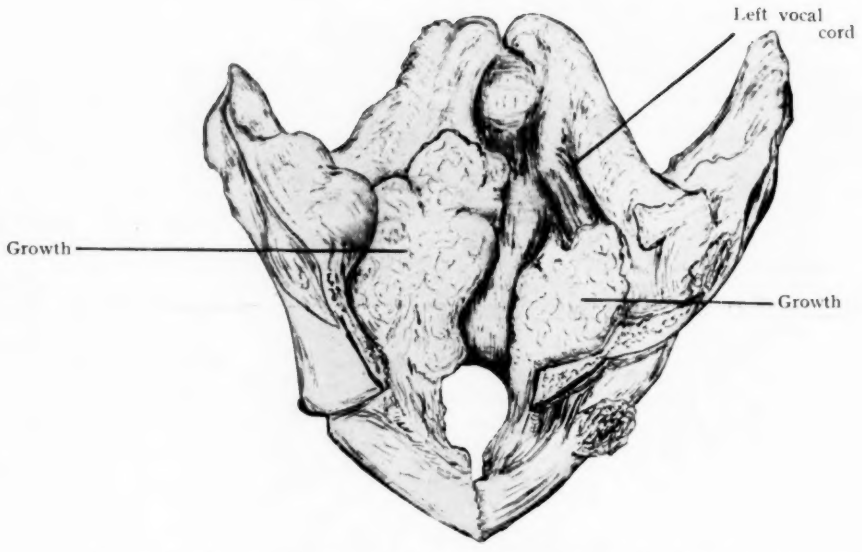

FIG. 3.—The larynx split open anteriorly, showing the growth involving the right vocal cord and extending to the left.

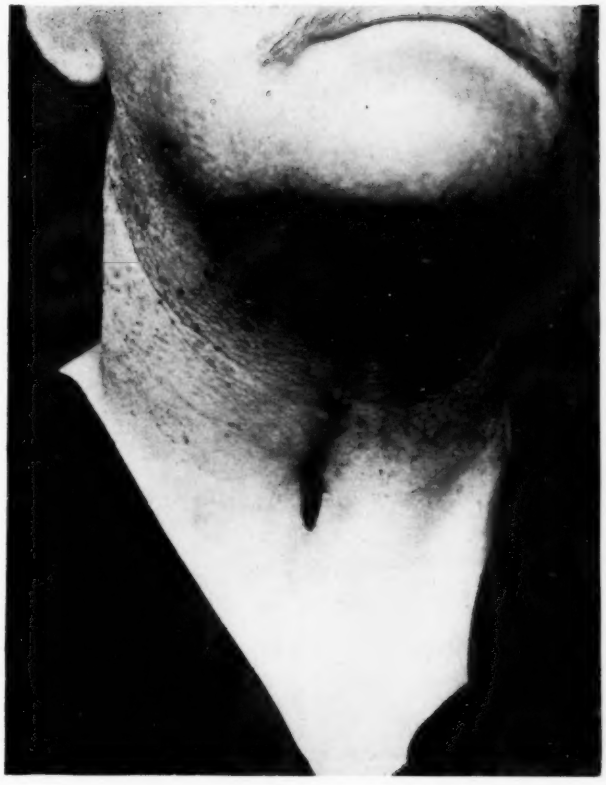

FIG. 4.—Present condition after laryngectomy. Tracheal aperture in midline of the neck.

although the patient was partially conscious of what was going on. He suffered no particular shock. His pulse at the beginning of the operation was ninety-eight; at its completion, one hundred and twelve.

A simple piece of sterile gauze was placed over the tracheal wound; the sutured portion was sealed with collodion, and the patient was placed in bed in the Trendelenburg position.

On the third day he sat up in bed, and on the fourth he sat up in a chair for an hour. The temperature rose on the day following the operation to 102–2-10°F., but did not go above that point, and gradually fell to normal on the tenth day. He was fed by rectum for thirty-six hours. At the end of that time he could swallow liquids in half-teaspoonful doses with some difficulty, as it required two or three efforts to get it down. He continued to swallow with greater ease until the seventh day, when it was found that a few drops of the liquid came through, and ran into the trachea causing him to cough. After this all nourishment was given in the Trendelenburg position for six days. At the end of that time, the leak had completely closed, and he was able to take food as usual. With the exception of the leak above mentioned, the wound healed by first intention throughout.

Microscopic examination of the growth after removal confirmed the diagnosis of carcinoma.

The operation as described is practically that suggested by Keen. At the conclusion of his article, however, he says, "In my next case, after dividing the trachea transversely, I shall quickly attach the tracheal stump to the skin. Then I shall introduce the ordinary tracheotomy tube into the open end of the trachea, instead of through a tracheal wound, and continue the anæsthetic through the tube." This step we omitted entirely, and completed the operation without the use of a tracheotomy tube or anæsthetic. In fact, our patient has never worn a tube up to the present time. Whether it may be necessary in the future, remains to be seen.

It certainly was not necessary at the operation, and by its omission I am sure we were relieved of some embarrass-

ment. The drain, if one is used at all, should be brought out at the center of the wound, and not at the lower angle. In this position it soon becomes foul, and prevents primary union at this point. Had the wound been sutured well down to the tracheal opening in this case, the fluids would have been prevented from entering the trachea when the leak occurred, but would have escaped through the drainage opening. In using the absorbable sutures throughout, we adopted the suggestion of Keen, as the silk used by him gave trouble.

In conclusion, we would say as the result of our experience in this case, that neither preliminary tracheotomy nor tampon-canulæ are necessary in these cases to prevent blood from entering the trachea; that the advantages of the Trendelenburg position, both at the operation and in the after treatment, cannot be overestimated, as it absolutely prevents blood or secretions from entering the trachea; that the use of even an ordinary tracheotomy tube may, with advantage, be dispensed with.

I am indebted to Dr. H. G. Webster for the drawings, and to Dr. C. F. Buckley for the photograph.

THE TREATMENT OF DIFFUSE SUPPURATIVE PERITONITIS, FOLLOWING APPENDICITIS.*

BY LUCIUS W. HOTCHKISS, M. D.,

OF NEW YORK,

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THERE is perhaps no question in modern surgery of greater interest and importance and about which there is greater disagreement than that of the treatment of diffuse peritonitis.

The utter impossibility of draining the general peritoneal cavity does not seem sufficiently obvious to many surgeons, and the nature of the peritoneal reaction to drainage is but imperfectly understood.

The writings upon this subject consequently, have often been more or less tinged with prejudice, and only too frequently with an apparent lack of comprehension of the physiology and mechanics of peritoneal absorption. The peritoneum is generally regarded as a vast lymphatic space of great absorptive power, but Muscatello has shown that the older theories of absorption, through the so-called stomata, between the endothelial cells, was wrong; and that the stomata were merely artefacts. He showed, also, that the greater part of the peritoneal sac is not underlaid with lymphatic spaces, but that these are confined principally to the peritoneum covering the diaphragm. He demonstrated moreover, that there is normally a flow of lymph toward the diaphragm, and that this is uninfluenced, save in point of time, by gravity. The same observer also noted that colored particles in fluid, experimentally injected into the peritoneum, were taken up, first, into the pits of the dia-

*Read at Meeting of New York Surgical Society, April 11, 1906.

phragmatic peritoneum, and then into the lymph spaces beneath it by means of phagocytes.

To show the rapidity of peritoneal absorption, Dubar and Remy were able to recover particles of carmine, from the thoracic duct only seven minutes after intraperitoneal injection.

The irritation of the peritoneum by foreign substances becomes then the signal for the immediate delivery into the peritoneal cavity of a large quantity of phagocytes, whose number depends largely upon the character of the irritant, as well as, to some extent, upon the time elapsed.

Provided the endothelium is uninjured, bacteria and other foreign substances can be safely disposed of, within limits of course, by the lymphatic route through the crura and central tendon of the diaphragm. Damage to the endothelium, however, may at once lay open the vascular route through opened blood-vessels, and permit of absorption sufficient to cause a fatal septicæmia. This is believed by some observers to be a real danger in peritonitis.

Fortunately, however, the patient's safety in peritonitis does not depend solely on the integrity of the endothelium for there is also, in most cases, a protective fibrinous deposit, gross or microscopical, which limits absorption into the peritoneal blood-vessels, and, at the same time, prevents the further egress of germs from the lumen of the intestine. The absence of this fibrinous deposit, noted in bad cases of streptococcus infection, denotes the absence of an important barrier to general infection through the blood-stream, and the fatality of these cases as is well known, is disproportionately great. This great power of peritoneal absorption then is one of the factors upon which we must depend for comparative safety in all abdominal operations, and upon its proper conservation depends the surgeon's success or failure.

That which happens as a result of the introduction of micro-organisms into the peritoneal cavity, depends upon their virulence and power to damage the endothelium and

so gain access to the tissues beneath, upon the power of the individual to furnish a competent protective leucocytosis, upon the stimulating action of the body fluids, and upon the ability of the phagocytes to deal with the organisms. (Dudgeon and Sargent.)

As appearances at operation furnish no very exact information as to the extent of the peritonitis present, it has been thought best by the writer to indicate in a general way what class of cases he has collected for discussion.

1. In all cases free pus was present, and its limits were not generally definable.

2. The ability to wash out pus from the pelvis, splenic pouch, and various parts of the lower abdomen was taken as evidence of involvement of the peritoneum in those regions.

3. Large secondary encapsulated pelvic collections of pus are not included.

The cases under consideration include all those cases of diffuse purulent peritonitis in which the limits of the pus are extensive but not easily definable, and in which it is free and unencapsulated, except of course, within wide limits. A reference to the histories of the cases appended will show a number of primary diffuse suppurations, a number secondary to the rupture of primary appendiceal abscesses, and in all of them it will be observed that the process is extensive, diffuse, purulent, and rapidly generalizing.

The review of the rise and fall in the popularity of peritoneal drainage is well presented by Yates,[1] of Chicago, in a masterly paper on "An experimental study of the local effects of peritoneal drainage." He details most graphically the methods in vogue from the time of Celsus to the present, and notes the influence of the earlier operators upon later methods of procedure. His conclusions derived from a most careful series of experimental studies in animals, are so closely in accord with my own, which have been

[1] Surgery, Gynecology and Obstetrics, December, 1905.

reached as a result of clinical observation, that I can only recommend a careful study of the whole article.

The experimental work of Clarke, confirming the earlier demonstration of Muscatello, as to the rapidity and efficiency of the absorption of micro-organisms through the lymphatic spaces of the diaphragm, is well known. The discussion and interest evoked by the paper of Blake on the treatment of peritonitis before the American Surgical Society two years ago, the work of Morris, Murphy, McCosh, and others, is also well known. The criticisms of my own methods of treatment as given in a paper read in March, 1904, before the Buffalo Academy of Medicine, "A consideration of the question of drainage in cases of acute appendicitis with spreading peritonitis," show that the question is by no means settled in the minds of the majority of the profession. Hence the variation of procedure from the method of Ochsner, who aims at encapsulation, and late removal of the appendix, to the radical methods still in vogue in this country and abroad, of wide incisions, evisceration, and washing and draining of the peritoneum. The general feeling seems to be, when in doubt drain, but the factor of doubt becomes at once a personal one, based often not upon any strong conviction but upon the following out of routine methods, and taking very little consideration of the physiology of peritoneal absorption, or settled by prejudice in favor of some method which has yielded fairly good results.

Men who have departed from the beaten track of belief as to the efficacy of intraperitoneal drainage by gauze or other means, and who have claimed better results by radically different methods, have been doubted and assailed. In my paper of March, 1904, already referred to, I reported 114 cases of appendicitis, in the service of a single hospital. In the first group extending over my terms of service from 1895 to 1899, there were 42 operations, among which there were 12 *cases of diffuse peritonitis with* 11 *deaths.* These latter cases were treated as was common at the time, by

free opening, more or less evisceration, saline irrigation, and drainage.

The second group, 72 cases from 1899 to 1903, showed 15 *cases of spreading peritonitis with no mortality.* These were treated by rapid removal of the appendix, generally through the muscle split of McBurney with as little traumatism as possible, developing the appendix by touch often rather than by sight, and discarding the broad protective packings of gauze to prevent soiling. Free irrigation of the pelvis and lower abdomen with hot normal saline solution, was done and closure of the wound to a small cigarette drain to the pelvis and appendiceal site. Before completing the work upon this series of cases, it had become evident to me that the cigarette drain or drains by reason of their rapid encapsulation acted mainly as a wound drain and had no real function as a peritoneal drain when it was possible to remove all local necrosis. Relying upon this clinical experience, the writer believes that the peritoneal drain can be eliminated as a factor of importance in the treatment of diffuse suppurative peritonitis. The observations of Blake, LeBoutillier and others will, I think, bear me out in this.

In the series of cases reported herewith and which have been operated upon since the beginning of 1903, 28 cases in all of diffuse suppurative peritonitis, the method of procedure has been as follows:

The McBurney muscle split, with or without the Weir extension through the posterior sheath of the rectus, has generally been found sufficient for the necessary manipulations.

As little ether as possible has been administered, and every effort has been made to complete all peritoneal work with as much speed and as little traumatism as possible. The appendix has been systematically searched for and removed with as little disturbance to the intestines as need be. After its removal and the cleansing of the appendiceal site, the pelvis and lower abdomen have been rapidly washed out with the Blake tube or the jacketted glass return-flow

canula. The peritoneum has been closed in many cases, without attempting to remove the saline solution which had not run out. Drainage of the external wound down to the peritoneum has generally been employed, from the fact that the wound is generally infected and needs it. Gastric lavage is given before the patient leaves the table, and as a rule an ounce or two of saturated solution of Epsom salts has been introduced through the tube and left in the stomach. Morphia as far as possible has not been given and the rectal tube with saline irrigation of the lower bowel has been used generally every six to eight hours for the first two days. If vomiting occurs, the stomach is washed out.

It has required some courage based upon strong conviction to close the peritoneum in these cases even when feeling sure that no area of local necrosis was left behind; but the results seem to have justified the means, and the writer feels that the mortality has been much diminished and the time in hospital much lessened, a factor of no inconsiderable importance. The Fowler position, based, as it seems to me, on entirely false premises as to the ability to pool and drain the peritoneal secretions, is nevertheless often a most valuable aid in that it increases the comfort of those patients in whom the distention of the bowel makes breathing difficult by upward pressure upon the diaphragm.

The use of saline irrigations to the peritoneum, as described, through the small lateral incision, does not consume much time, and seems by diluting the remaining fluids to hasten their absorption, besides acting generally as any intravenous infusion would to hasten the removal of toxins by dilution besides stimulating the heart and circulation. Moreover, the actual ability of the peritoneum to cope with the inflammation seems to be increased and not hindered. In those cases where the inflamed appendix is the cause of the peritonitis, the problem resolves itself into the rapid removal of the offending organ without evisceration, in all cases. The peritoneum has proven itself abundantly able to take care of the resulting inflammation, and drainage in

the absence of local necrosis is often ill advised and not based upon sound physiology or mechanics. Gauze packing is not only unnecessary but frequently harmful, being probably responsible for increased mortality, not to speak of the incident damage to the endothelium, with the resulting adhesions.

Where there is an area of local necrosis which is not removable it must of course be isolated, and the area drained on general surgical principles. Of course there is a point in all cases beyond which any interference is useless, as the patient is generally septic and dies whatever may be done. The factor of personal resistance is always an unknown quantity, and cannot be accurately estimated. The virulence of the infection unquestionably cuts an important figure in all cases, but this also is not to be determined at the time of operation, and the surgeon has to deal with the conditions present in each case and rely upon the resistance furnished by the individual phagocytosis and try and not disturb or upset the natural reparative powers by unneces sary traumatism in handling or exposing the intestines.

The experience of Murphy in dealing with these cases by rapid removal of the appendix through the lateral incision, the making of a small median incision and introducing a drain into the pelvis and sitting the patient up is very suggestive. While this method may seem to differ widely from the one herein detailed, the essential part in each seems to lie in the rapid appendectomy with minimum of trauma and exposure, and the reliance upon the peritoneal leucocytosis to accomplish the rest, the relief of tension alone in some cases being unquestionably all that is necessary to prevent further absorption and extension. The work of Clarke and Norris seems to show that saline solution within the peritoneum does not increase but minimizes the danger of pyogenic infections. In addition to the reduction of mortality, the convalescence of the patient is certainly rendered much more comfortable by reason of the rapid elimination of ether from the circulation, the reduction of

thirst, and the increase in the secretion of urine diminishing the bladder irritation.

The following brief reports will indicate exactly in what class of cases the writer has employed the treatment detailed.

The whole number of cases of diffuse peritonitis reported is 28, of which 5 died. Of these at least 3 were practically moribund, one had probably pneumonia present at the time of operation, and one was the subject of an extensive lung tuberculosis, in addition to an extensive perforative peritonitis in which no tendency to the formation of limiting adhesions was present.

These 28 cases in addition to the 15 already reported, in which a similar mode of operating was adopted, form a group of 43 cases of diffuse suppurative peritonitis resulting from appendicitis, with a mortality of 5, or a little over 10 per cent.; a creditable showing, when the class of cases, in which there must always be an appreciable mortality, is considered.

The writer does not believe that the treatment of these cases has yet reached the most satisfactory solution, but he does believe that the secret of success lies in the rapid removal of the cause with as little possible interference as may be, with the great natural protective forces of the peritoneum, the avoidance of drainage which in many cases may prove a menace instead of a help, and in relying upon the great natural powers of the inflamed peritoneum to cope with the infection.

SYNOPSIS OF CASES.

I. *Fatal Cases.* 1.—Ruth N., aged 7, admitted to Hood Wright Hospital April 20, 1903. Died April 21, 1903. Acute seizure, twenty-four hours; no vomiting, moderate distention, general tenderness, no mass. Rales present both sides of chest, condition very poor. McBurney incision with Weirs extension. Appendectomy. Free, thin, flaky pus everywhere; intestines, no adhesions; peritoneum washed out; cigarette drain to appendiceal site. Continued to sink, and died in a few hours.

2.—Lizzie A., acute appendicitis, general suppurative peritonitis. Oblique incision, free pus everywhere, no odor; small perforation of appendix, no gangrene. Patient very sick. Quick operation. Appendectomy. Peritoneal lavage; drain. Died. Hood Wright Hospital, December 9, 1903.

3.—Mr. L., aged 40, subject of extensive lung tuberculosis; acute perforative appendicitis, twelve hours before. McBurney incision; large perforation of appendix, well generalized peritonitis; washed out with Blake tube; peritoneum closed; gastric lavage; Epsom salts. June 10, 1905.—Died of urinary suppression and sepsis, June 15, 1905. Roosevelt Hospital.

4.—Florence B., aged 17; sick one week; left-sided pain. Very sick; marked distention, face and extremities congested, temperature 104°; pulse 130; urine shows albumen and casts. Immediate operation. Incision through right rectus. Cæcum well to left; appendix perforated and exuding fæces. Appendectomy. Free pus everywhere. Saline irrigation with Blake tube; cigarette drain to stump. Died seven hours later. Roosevelt Hospital. August 16, 1905.

5.—Female, aged 42; Roosevelt Hospital September 18, 1905. Perforated appendix, well generalized suppurative peritonitis, W. B. C. 14000. Feeble pulse, cold extremities. McBurney incision; appendectomy. Irrigation with Blake's tube; gastric lavage; cigarette drain to site of appendix. Operation, 15 minutes. Died.

II. *Cases which Recovered.* 1.—Josephine H., aged 12, Hood Wright Hospital, March 13, 1903. First attack, fourth day. McBurney incision; appendectomy. Appendix perforated and gangrenous, free pus pelvis and left side, no limiting adhesions. Washed out with normal saline solution; gastric lavage, Epsom salts introduced through tube; cigarette drain to stump. Discharged well, April 5, 1903.

2.—Henry D., June 30, 1903. Subacute onset, then sudden severe pain and rapid peritoneal involvement; temperature 101°; pulse 123; respiration 32. McBurney incision, appendectomy. Appendix, gangrenous, perforated, concretion. Free pus washed out from below liver, pelvis, and left side; cigarette drain to stump; gastric lavage, with Epsom salts left in stomach. Discharged well, August 10, 1903.

3.—Acute appendicitis; advancing suppurative peritonitis; Roosevelt Hospital, August 12, 1903. Appendectomy, through McBurney incision; washing out with Blake tube, peritoneum closed by suture; external wound drained by cigarette. Cured. August 12, 1903.

4.—Child; acute appendicitis, free pus. Appendectomy; McBurney incision; irrigation with Blake tube; peritoneum closed; wound drained. Cured. Roosevelt Hospital. August 24, 1903.

5.—Male, aged 10; perforative gangrenous appendicitis, acute seizure; collapse, followed by pain, etc. McBurney incision with Weir extension. Appendectomy. Local abscess about appendix, which was gangrenous, and perforated; free pus; peritoneal irrigation with hot saline; peritoneum closed; wound drained. Cured. Hood Wright Hospital. October 13, 1903.

6.—Dwight C., aged 10; acute perforative gangrenous appendicitis; fecal concretion; free pus. McBurney incision; peritoneal irrigation; gastric lavage; drain. Cured. October 16, 1903.

7.—Florence D., acute gangrenous appendicitis; perforation spreading purulent peritonitis. McBurney incision; appendectomy. Saline irrigation; free stinking pus; cigarette drain. Cured. December 26, 1903.

8.—John K., aged 16; acute appendicitis; free pus, also large retrocecal abscess. McBurney incision, with Weirs extension; saline irrigation of peritoneum, also lumbar drain for retrocecal abscess. Secondary operation for secondary peritoneal pus collections. Cured, 51 days. December 27, 1903.

9.—Leo G., gangrenous perforative appendicitis abscess, advancing purulent peritonitis. McBurney incision; appendectomy. Free thin pus widespread; irrigation; peritoneum closed. Cured. January 5, 1904.

10.—Maggie J., aged 25. November 30, 1904. Gangrenous appendicitis, perforative; spreading purulent peritonitis. McBurney incision; irrigation; peritoneum closed. External wound drained. Cured.

11.—Mr. S., aged 58, seen in consultation fourth day; acute appendicitis; tender both sides; marked abdominal distention. To Roosevelt Hospital. Immediate operation. Mc-

Burney incision; appendectomy. Large amount of free pus under pressure spurted out; appendix had multiple perforations; widespread peritonitis practically entire lower abdomen. Blake tube irrigation, gastric lavage, with salts, repeated next day; cigarette drain to stump. Discharged well, March 4, 1904—3 weeks.

12.—Edwin M., aged 16. Roosevelt Hospital. June 12, 1904. Pain both sides; vomiting, belly full of pus; no adhesions. Blake's tube, washed out pus in all directions. McBurney incision; Weir extension; gastric lavage, with salts; peritoneum closed; external wound drained. Cured, no complications.

13.—John M., aged 55. Cutchogue, L. I. July 9, 1904. Fourth day; legs drawn up, distended and tender; very sick. McBurney incision; appendix perforated and gangrenous; removed. Free pus from pelvis to spleen; washed out rapidly; gastric lavage, with salts; peritoneum closed. Cured.

14.—Man, aged 42. Roosevelt Hospital, October 17, 1904. Perforated appendix; extensive purulent peritonitis. Appendix broken off; gut opened and sutured; free pus washed out with Blake tube from pelvis, left and right sides. Temperature 105°, pulse 180; bad condition; gastric lavage before and after operation; cigarette drain. Temperature fell to normal next day. Cured.

15.—Boy, aged 7. Roosevelt Hospital. October 18, 1904. Acute appendicitis. McBurney incision; saline irrigation, Blake's tube; pus pretty widely diffused, both sides; gastric lavage; peritoneum closed. Cured.

16.—Mary D., aged 14. September 12, 1904. Gangrenous perforative appendicitis; free pus throughout pelvis and lower abdomen. McBurney incision; appendix removed; irrigation with Blake's tube; gastric lavage, with salts; cigarette drain. Cured.

17.—Hood Wright Hospital, November 30, 1904. Perforative gangrenous appendicitis; spreading suppurative peritonitis. Free pus washed out of pelvis and left side; no limiting adhesions. McBurney incision; peritoneum closed; wound drained. Cured.

18.—Roosevelt Hospital, June 2, 1905. Perforated gangrenous appendix; free pus. McBurney incision; appendec-

tomy. Irrigation with Blake tube; gastric lavage, with salts; peritoneum closed. Cured.

19.—Boy, aged 12. Acute gangrenous appendicitis, perforation, free pus throughout lower abdomen, no adhesions, McBurney incision; appendectomy. Blake tube; gastric lavage; peritoneum closed. Cured.

20.— Female, aged 6. September 18, 1905. Acute perforative appendicitis; spreading purulent peritonitis. Appendectomy; McBurney incision. Free pus washed out of pelvis, left and right side; no limiting adhesions, cigarette drain to stump. Cured.

21.—Gangrenous appendicitis; spreading purulent peritonitis. November 27, 1905. Hood Wright Hospital. McBurney incision; appendectomy. Appendix torn off at stump and left; free pus throughout pelvis and lower abdomen; saline irrigation; drain to stump. Recovery.

22.—Male, aged 28. August 20, 1905. Roosevelt Hospital. Perforative appendicitis; spreading purulent peritonitis. Blake's tube; free pus washed out from pelvis and left side; lavage. McBurney incision; appendectomy; drain to stump. Cured.

23.—Female. September 15, 1903. Acute gangrenous appendicitis; perforation; advancing purulent peritonitis. McBurney incision; irrigation of peritoneum with Blake tube; appendix tied off; cigarette drain to site. Cured.

A REVIEW OF FIFTEEN HUNDRED OPERATIONS UPON THE GALL-BLADDER AND BILE PASSAGES WITH ESPECIAL REFERENCE TO THE MORTALITY.[1]

BY WILLIAM J. MAYO, M.D.,
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Surgeon to St. Mary's Hospital.

BETWEEN June 24, 1891, and May 1, 1906, Dr. Charles H. Mayo and myself have performed 1500 operations upon the gall-bladder and bile passages, of which number 96 per cent. were operated upon in St. Mary's Hospital, Rochester, Minnesota, and under nearly identical conditions.

One thousand of these cases were commented upon in a paper read before the Southern Surgical and Gynecological Association in December, 1904, and will be found in the Transactions of the society for that year.

The three most important considerations in the surgical treatment of any disease are, first, the mortality; second, the permanence of cure; third, the disability arising from the operation itself. The following investigation has been conducted with a view of elucidating the truth in regard to these essentials.

Mortality.—The first question to be considered concerns the operative mortality. In the 1500 operations there were 66 deaths, 4.43 per cent. In the first 1000 cases, previously referred to, the death rate was 5 per cent.; in the last 500, since that time, 3.2 per cent. This includes acute perforations with septic peritonitis and malignant disease. These statistics give, as an operative death, every case dying in the hospital without regard to the length of time thereafter. It includes death from accidental causes such as pulmonary embolus, myocarditis and a number

[1]Read before the American Surgical Association, June 1, 1906.

of cases dying from chronic conditions occurring after one month, one from chronic nephritis as long as ten weeks after operation. This works an injustice to the statistics but eliminates the personal equation.

There were 845 cholecystostomies with a mortality of 2.13 per cent. In the last series of 500 there were 272 cholecystostomies with a mortality of 1.47 per cent. Two of these were sudden deaths from pulmonary embolism.

Looked at from the standpoint of mortality, cholecystostomy is the safest for the average case and must be considered the normal operation. As we had but one case of our own in the entire series of 1500 operations in which gall-stones reformed in the gall-bladder, this cannot be taken as a valid objection to leaving it *in situ*.

There are some conditions in which, after cholecystostomy, future trouble may be expected. First, in all those cases in which the cystic duct is obstructed by a stone, and the gall-bladder takes no part in the biliary circulation (contains no bile), other things being equal, it should be removed, as in this condition we have occasionally had to remove it secondarily for the relief of mucous fistula or colics due to obstructions, to drainage from kinking or stricture. Second, thick-walled gall-bladders which have become functionless, lead to a suspicion of malignant disease and should be excised. We have in this way several times unexpectedly removed what proved to be an early carcinoma of the gall-bladder. One such patient is now alive, more than three years.

In connection with common-duct surgery it is not wise to remove a functionating gall-bladder unless for direct indication. This is particularly true if cholangitis exists, as common-duct cases more often require a secondary operation than any other, and the gall-bladder not only affords easy drainage and enables cholecystenterostomy should there be future contraction and obstruction of the common duct, but it is also a safe guide to the deep ducts if future trouble should arise.

As to permanency of cure, our cholecystostomies have remained well with the exception of a few instances of bad selection in our early experience in which cholecystectomy would have been the better operation.

The operative disability after cholecystostomy was brief. A short incision with separation of the fibres of the rectus muscle rendered early union without hernia almost a certainty. By turning in the cut margins of the gall-bladder about the tube (Summers) in a similar manner to the Stamm-Kader gastrostomy, the bile discharge stopped promptly as, on removal of the tube at the end of the week, the peritoneal surfaces agglutinated. The average patient was up in twelve days and left the hospital within two weeks.

CHOLECYSTECTOMY.

There was a total of 319 cholecystectomies, with a mortality of 3.13 per cent. In the cholecystectomies in the last series of 500 cases the mortality was 1.62 per cent.

Cholecystectomy has an increasing field of usefulness, but its increase of mortality, which, although slight, is for one reason or another fairly certain, prevents it from replacing cholecystostomy. At the same time, where the circumstances permit of easy removal of the gall-bladder and the disease is confined entirely to this organ, it is the operation we most commonly perform even in cases in which cholecystostomy would answer the purpose. But if the patient is very obese and the gall-bladder has a broad attachment to the liver necessitating prolongation of the incision or increased manipulation, cholecystectomy is the more difficult and dangerous operation.

The permanence of cure after cholecystectomy is of course absolute when the disease is confined to the gall-bladder. In the majority of cases the incision was made nearly if not quite as short as for cholecystostomy. The period of convalescence was therefore about the same. In a few cases a longer incision was required, adding sev-

eral days to the disability. It was very rare that a patient was in the hospital more than fourteen days.

OPERATIONS UPON THE COMMON DUCT—207 CASES.

Operations upon the common duct so far as the mortality is concerned can be divided into four groups. This arrangement is more or less artificial, as some cases are hard to classify.

Group 1. One hundred and five cases with 3 deaths, 2.9 per cent., consisting of those patients in whom gallstones were present in the common duct but without immediately active symptoms. Jaundice was moderate or not present. If it was present the obstruction was incomplete or intermittent and permitted of the escape of a certain amount of bile into the intestine. There was comparatively little infection of the ducts and with the exception of the presence of mucus, the bile was normal. The operation under such circumstances was simple and the convalescence short, the patients usually being able to leave the hospital within 15 days, and the cure has been permanent.

Group 2. Sixty-one cases with 10 deaths, 16 per cent. A series of cases in which there was active infection not only in the common duct but also involving the ducts of the liver. Stones were usually present. The patient not only had jaundice but suffered from Charcot's fever, (malarial type, irregular chills followed by a temperature from 103° to 107°, passing off in a few hours with sweating), pain intermittent and most marked just previous to the active symptoms; during the remissions a little bile passed the obstruction, relieving the liver. Among the older writers this was called "Remittent Bilious Fever." The added infection at once introduced an element of grave danger, not only from the operation itself but also through the production of certain complications which caused death in the first two months.

The patient also had an increased possibility of future

trouble as it was in this group that hepatic-duct stones were formed, of which we have seen seven examples. The infection and interference with drainage from a stone formed in the gall-bladder but which had passed into and lodged in the common duct furnished the necessary conditions for their formation. The cholangitis may subside and the stones reach a more or less quiescent state but after removing the calculi from the common duct others which have formed in the hepatic ducts may pass into the common duct, causing future trouble.

Coincident enlargements in the head of the pancreas or changes in the duct-wall may lead to secondary stone formation. Under such circumstances we have four times seen stones reform in the common duct after periods of from one to five years, requiring second operations. In two the gall-bladder had been removed at the primary operation, and the stones were too large to have come down from the hepatic-ducts. The possibility that these stones had as their nuclei hepatic-duct calculi cannot be denied in one case, but it does not seem possible that this was the fact in the other three. It was this group that was so often found associated with inflammatory diseases of the pancreas.

As a rule these patients were in the hospital from three to four weeks.

Group 3. Complete obstruction of the common duct; 29 cases and 10 deaths; 34 per cent. It is hardly necessary to call attention to the fact that formation of bile is only one of the functions of the liver, and that a patient may live for a great length of time with nearly if not quite complete obstruction of the common duct, the necessary amount of bile being absorbed by the blood and eliminated with the urine, perspiration, etc. In Group 1 we found the bile comparatively healthy, containing only a moderate amount of mucus. In Group 2 the bile was darker, containing a large amount of mucus and often showing colon bacillus on culture. The third group showed almost no bile in the ducts and the little present was thin and of a

dark spinach-green color, or in the worst cases a condition of complete acholia was manifest, the ducts being filled with a clear, colorless, mucoid secretion. The patient's general condition was extremely poor, pulse feeble and rapid, and in the long-standing cases there was sometimes œdema of the feet and free, bile-stained fluid in the peritoneal cavity. Albumen and casts in the urine and other evidences of extreme toxemia were usually manifested.

The operative mortality in this group during the period of complete obstruction was very high, 34 per cent. including deaths from early and late complications. Acute obstructions of this type when accompanied by evidences of infection were especially fatal, and as acute obstruction from stone is seldom permanent, it is often wise to wait for a period of remission before operation. It seldom happens that the duct will not dilate sufficiently in the early stages to permit of some relief of the symptoms, and this is the time to interfere, although later the inflammatory products in the duct-wall may contract down upon the stone, giving rise to permanent obstruction. In a few instances of complete obstruction which came on suddenly and which remained without temporary remission of symptoms, spontaneous cure by sloughing of the stone into the intestine took place. We have seen four examples. In each, after years of typical gall-stone symptoms, there was sudden and complete obstructive jaundice. In two there was a steady temperature and in all four there was a peculiar rigidity of the upper abdomen. After from six to twelve weeks of acute and severe symptoms the patient suddenly became relieved, the jaundice disappeared and a large gall-stone was found in the stool. Three of these patients were subjected to operation subsequently. In all one or more stones were found in the gall-bladder or in the adjacent liver border, the center of a cicatricial mass, but without communication with the bile tract, the common duct being densely adherent to the duodenum at the site of perforation.

The most common causes of death after operation in this group have been exhaustion from cholemia, with or without capillary hæmorrhage, and from sudden cessation of liver function.

All of the patients who recovered remained well. The hospital disability averaged a little over three weeks.

Group 4. This group concerned malignant disease; 12 cases; 4 deaths; 33⅓ per cent. mortality. Cancer of or involving the common duct occurs in two forms. First the primary tumor of the common duct or papillæ, a small, hard, grayish-white mass, with a tendency to remain localized until a late stage. We have seen several examples and have had two primarily successful excisions, but no case which has lived beyond three years. Second, common-duct obstructions from carcinoma extending downward from the gall-bladder and cystic duct, or from cancer of the head of the pancreas. These cases are of course inoperable, and even an exploration proved fatal in several instances.

RELATION TO PANCREATITIS.

One of the most interesting problems in connection with surgery of the bile tract concerns coincident inflammations of the pancreas. In a total of 86 out of the 1500 cases the pancreas was involved to such an extent as to be noticeable on examination. Four of these cases were acute, of which two recovered and two died. Six were subacute, two of these having hæmorrhagic cysts; five recovered and one died; 9 cancer, 5 deaths; 67 had chronic pancreatitis; the evidences usually consisted of hard nodules most marked in the head of the pancreas and near to the common duct. Four cases, supposed to be common-duct obstruction from chronic pancreatitis alone, were shown by subsequent operation to have had an undiscovered stone in the ampulla. In a few cases the pancreatic disease apparently was not secondary to the bile tract.

That the acute forms have had a deleterious effect

upon the patient is unquestioned but I have been unable to separate the harm done by the chronic inflammations from the essential condition in the bile tract and I do not believe that unless it was obstructive it had a decided influence on the prognosis.

In summing up the causes of the 66 deaths 10 or 15 per cent. were accidental and could be eliminated. The largest number were due to cessation of liver function, usually the result of infections, microscopical examination showing destruction of the epithelial elements of the liver and often fatty degeneration. Next came exhaustion from blood changes due to chronic cholemia.

It was the mortality and complications of delay that placed the early operation for appendicitis on a sound surgical footing. To remove the disease while still in the appendix and before its rupture involved the abdominal cavity, was the logical conclusion.

The same reasons apply and with equal force to the early operation for gall-stone disease. Remove the disease while still in the gall-bladder by a mortality of from 1.47 per cent. (cholecystostomy) to 1.62 per cent. (cholecystectomy). This includes death from accidental causes, acute perforation and gross infections. Excluding these cases a mortality of less than 1 per cent. can be shown.

With the passage of the stone into the common duct we no longer have a localized disease but one fraught with grave dangers from liver infection and cholemia, and in this condition nearly one in seven of our cases came to operation, while one in twenty-five developed malignant disease of the gall-bladder, or bile tract, and in most of these cases gall-stones were present. In other words, one patient in six had allowed the favorable time to go by, although the very large majority had ample warning in the early and safe stage for operation.

SOLITARY ABSCESS OF THE LIVER.

A CONTRIBUTION TO THE PATHOLOGY, DIAGNOSIS, AND TREATMENT OF THIS DISEASE, BASED ON THE STUDY OF EIGHTEEN CASES.

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DURING the last decade the literature on abscess of the liver has grown to very large proportions. Especial attention has been paid to the so-called tropical abscess, and the symptoms and treatment of this affection have been carefully studied. There has been considerable confusion, however, in the meaning of the term "tropical abscess." Some writers have called every single abscess a tropical one, while others have limited the term to solitary abscesses which occurred in the tropics. It would be preferable, I think, to limit the term "tropical abscess" to those cases which occur in individuals who have lived or are living in the tropics and in whom there is a preceding history of amebic dysentery, although it might be allowable to include under the same head amebic abscesses of the liver which occurred in the temperate zones.

The term "tropical abscess" is also frequently used to distinguish the solitary from the multiple abscesses of the liver. This is not strictly correct, because not a small number of amebic abscesses are multiple. It is more correct to speak of single or solitary and of multiple abscesses of the liver, and to include under each of these heads the different varieties of abscesses classed according to their etiology. Under the head of single or solitary abscess of the liver would therefore be grouped the following:

1. The tropical abscess, following tropical dysentery.

This is associated with the presence of the ameba coli, and is said to follow rarely dysentery due to Shiga's bacillus (dysenteric abscess of Kartulis [32]).

2. The traumatic abscess, either as a secondary infection of a hæmorrhage into the liver substance, or by direct infection from the surface of the body.

3. The pyæmic abscess, as a part of a systemic pyæmia. With this is not necessarily associated a bacteriemia (Libman).

4. Liver abscess secondary to a variety of abdominal affections. In this form the connection between the abscess and the primary disease is often in doubt. The infection is probably carried to the liver by the portal vein (idiopathic abscess of Kartulis).

During the last five years, 18 patients with solitary liver abscess were operated upon in the Second Surgical Service at Mt. Sinai Hospital.* In the majority of the patients the source of the infection could not be determined with certainty, although in a number of them there was a history of some preceding disease. These cases form the basis of the present paper.†

In 12 of the 18 patients there was a history of a preceding disease, viz.:

Trauma (gunshot wound) in one patient.
Cholelithiasis in one patient.
Chronic colitis in one patient.
Acute appendicitis in one patient.
Osteomyelitis of tibia in one patient.
Hemorrhoids in two patients.
Intermittent fever in two patients.
Occasional diarrhœa in three patients.

In the six other patients there had been no previous illness.

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* Eight cases were operated upon by Dr. Lilienthal, four by Dr. J. Wiener, six by Dr. Elsberg.

† Two cases of suppurating gumma of the liver and one of suppurating echinococcus cyst are not included. Six cases of multiple abscesses of the liver are referred to later.

The history of the patient who had a solitary abscess of the liver after an attack of acute appendicitis follows:

Jacob E., 40 years of age, was admitted to the hospital on July 23, 1902. He had been operated on for an inguinal hernia six weeks before and for acute appendicitis three weeks before at another hospital. Very little of the history of the present illness could be obtained from the patient. He declared that for two weeks he had had chills and fever, with pain in the right hypochondrium.

Condition on admission, markedly emaciated. Examination of the chest reveals the following: In front there is dulness at the second right intercostal space, flatness from the fourth interspace to the base of the lung, with absence of voice and breathing. Posteriorly, there is flatness on percussion from the angle of the scapula to the base of the lung, with absent voice and breathing below the fifth interspace. Lower intercostal spaces on the right side very tender; area of marked tenderness below angle of scapula. Abdomen: unhealed wound in the right iliac region from which there is a moderate purulent discharge; percussion shows the liver to be enlarged upwards and downwards, lower border two finger-breadths below free costal margin; abdomen rigid, distended and tympanitic. Aspiration in ninth space post-axillary line gave thick non-odorous pus.

July 23, under ether anæsthesia, three inches of the ninth rib were resected (Dr. Elsberg), the pleural cavity, which contained clear serum, was opened and walled off with gauze as no sutures would hold, the diaphragm incised, and 54 ounces of pus evacuated. The subphrenic abscess was found to communicate with a large cavity in the right lobe of the liver; drainage.

Convalescence was uneventful; the temperature, which had been high, soon fell to the normal, and the patient was discharged cured twenty-four days after the operation.

Cultures made from the pus remained sterile; no amebæ could be found in the discharge from the wound.

While subphrenic abscesses and multiple abscesses of the liver are not so very rare after acute appendicitis (subphrenic abscess occurs in 2½ per cent. of the patients (Elsberg [1]):

multiple abscesses of the liver in 0.8 per cent. (Gerster[2]), solitary abscesses are very infrequent. Thus I have been able to find only 14 cases in medical literature although there have no doubt been a larger number (Cases of Herczel,[3] Chvostek,[4] Munro,[5] Sheen,[6] Koerte[7] (2), Delageniere,[8] Loison,[9] Jones,[10] Norton,[11] Sonnenburg,[12] Hildebrandt,[13] Shoemaker,[14] Besancon[15]). The patient of Delard,[16] often referred to, probably had only a subphrenic abscess, and one of Koerte's[7] patients had multiple abscesses.

Infection may reach the liver from the appendix or from another part of the abdominal cavity in one of several ways: (1) By direct extension, either through the bile-ducts or from abscesses in close proximity to the liver (subphrenic, perinephritic); (2) by the lymphatics; (3) through the arteries, as part of a systemic infection; (4) through the portal vein.

Koerte[17] and Loison[18] believe that hepatic suppuration often results from the direct extension of the suppurative process from the appendix region through the retroperitoneal cellular tissue. To judge from the cases of liver abscess reported in literature, this is not as frequent as these writers would lead us to believe. Loison states, in support of his view, that where there is a subphrenic abscess with a liver abscess it is impossible to say whether the liver abscess perforated the capsule of Glisson and became perihepatitic or whether the latter perforated the capsule of the liver and caused the hepatic abscess. Munro voices his belief that a considerable number of liver abscesses are due to extension to the perihepatic region through the lymphatics, while on the other hand Jones[19] denies that there are any lymphatics that run directly to the liver. The opinion of most writers seems to be that while infection of the liver through the lymphatics and from the perihepatic regions is possible, it is not of frequent occurrence.

In the majority of cases solitary abscess of the liver after appendicitis is due to bacteria or their products that are carried to the organ through the portal vein. Loison has pointed out that the organisms may travel up the vein and set up

the liver suppuration without leaving behind demonstrable changes in the vessel or its large branches.

Whether the abscess be a single one or multiple will depend not only upon the number of organisms that are carried to the liver, and their virulence, but also upon whether the infectious material is diffused over a very small area of liver substance in one lobe, or is spread over the greater part of one or of both lobes of the liver. In a certain number of cases the single abscess may be due to the confluence of several small abscesses in a lobule of the organ. Clark,[20] Windsor,[21] Loison and others have shown that the solitary tropical abscess is often due to the merging of numerous smaller abscesses. Hence if the organisms that have entered the portal vein are carried to one or a few of the terminal branches of the vein, the abscess may be a solitary one, but if the septic matter is carried into a large number of branches multiple abscesses will ensue.

It is perfectly possible for a lesion in the gastro-intestinal tract which gave no symptoms to contribute sufficient infectious matter to cause in this way a single abscess of the liver. I believe that this is the explanation for many if not most of the single abscesses of the liver that are seen in the temperate zones, whose etiology has not been determined.

Location of the Abscess.—In 16 of our 18 cases, the abscess was located in the right lobe, and with one exception in the upper part of the right lobe. According to Rolleston,[22] 80 per cent. are in this situation, while Jones states that only 6 per cent. occur in the left lobe. The more frequent affection of the right lobe is due to the fact that the branch of the portal vein that supplies the right lobe of the liver is larger, shorter, and more direct than the left branch.

The size of the abscess and the amount of pus it contains vary within wide limits, the largest quantities being found in the cases in which the abscess has secondarily invaded the subphrenic space.

The contents of the abscesses were of a yellow, brownish red or green color, and usually thick and of a mucoid con-

sistency. In four of our cases the pus had a foul odor,—three were cases with subphrenic abscess, and in the fourth case the odor was probably due to the presence of anerobic bacteria.

Our records are unfortunately incomplete as regards the organisms found in the pus, as no cultures were taken in some of the early cases. Of the ten cases in which examinations were made, the pus was sterile in six (60 per cent.), which corresponds pretty closely to the results of Giordano [23] who examined 72 cases and found the pus sterile in 58.4 per cent. The staphylococcus citreus was present once, streptococcus once, bac. coli once, anerobes once. A careful search for the amebæ coli was made in all of the cases but they were found only once.

The hepatic abscess had burst into the subphrenic region in six of the eighteen patients (30 per cent.). The pleural cavity contained clear serum in four patients, it was normal in three, it could not be examined in ten. Perforation of the diaphragm did not occur a single time.

Symptomatology.—The symptoms of solitary abscess of the liver may come on days, weeks or months after the primary disease. After having been well marked they may disappear for a time, the dormant stage of liver abscess. Several modes of onset are, however, characteristic.

I. *Acute Onset.*—(*a*) With or without a history of previous illness, the patient is suddenly attacked with pain in the lower part of the right or left chest, chills, fever, sweating, a dry cough, and marked prostration. The chills or chilly sensations are repeated daily, the pain persists, there is very rapid emaciation, the liver becomes enlarged and tender. (*b*) The patient is suddenly attacked with pain in the epigastrium and right or left hypochondrium, fever, cough, prostration. These symptoms increase in severity, and tenderness and muscular rigidity in the upper part of the abdomen soon appear. The liver becomes enlarged and tender, and the patient presents the picture of an acute abdominal infection. The abdominal type of onset.

II. *Subacute or Chronic Mode of Onset.*—(*a*) Without any previous disease or a number of years after some illness, the patients begin to have a dry cough, complain of a heavy feeling or slight pain in the lower part of the right or left chest, and begin to lose flesh and strength. After weeks or months, during part of which time the symptoms may be in abeyance, the temperature begins to rise and soon becomes of an intermittent type, chills or chilly sensations with sweats occur, and the liver becomes enlarged and tender; or (*b*) The mode of onset is similar to that of subphrenic abscess. The patients have an irregular fever as the first symptom, and then lose flesh and strength rapidly. These patients may show no local signs of their disease until the abscess invades the subphrenic region. Without any change in the temperature, respiration or pulse, some patients complain of continual slight pain in the right or left chest. The pain persists for weeks or months. Physical examination of the chest results negatively, and the patients never look very ill. Sooner or later the pain in the chest becomes more severe, there is enlargement of the liver, dulness, perihepatitis, and signs of fluid in the pleural cavity of the affected side. Then the presence of fluid under the diaphragm and perhaps in the pleural cavity is found by physical examination and the aspirating needle.

A detailed account of the various symptoms and signs that may be present in this affection would occupy too much space. Mention will only be made of some of the more important ones:

Pain, fever, enlargement of the liver, and emaciation are the characteristic symptoms of abscess of the liver, although one or more of these may be absent.

Acute pain may be absent entirely or may only appear late in the disease. It is not apt to occur as early as in subphrenic abscess, and is due in most cases to the perihepatitis which follows when the suppuration nears the surface of the liver. The pain is usually referred to the region of the liver and more especially to the lower part of the right or left chest

in front. The patients most often complain of pain along the free costal border or within an area situated between the mammary and posterior axillary lines. These localized areas of pain usually correspond to the points of greatest tenderness on pressure (Smits,[24] Koerte, Godlee,[25] etc.).

The tenderness along the free border of the ribs is usually most marked in the mammary line, but with marked abdominal rigidity it may be impossible to localize the point of maximum tenderness in this region. The other area of tenderness is obtained by pressure in the intercostal spaces between the eighth and the eleventh ribs on the right side, or below the ninth rib on the left side, somewhere between the anterior axillary and the scapular lines. Increase of the tenderness in this or in the infracostal region usually means that the abscess is approaching the upper or lower border of the liver or both. In some cases (two of our series) there was bulging in some of the lower intercostal spaces.

Pain in the shoulder was present in only four of the eighteen patients. Some writers, if not most of them, lay great stress on this symptom. Kramm[26] declares that it was present in 50 per cent. of his cases (tropical abscess), while it was said to have been almost the only symptom in a patient of Bramwell and Stiles.[27] On the other hand, pain in the shoulder was mentioned only twice in the 28 cases reported by Hart.[28]

Enlargement of the liver may be absent if the abscess be a very small one, but there is usually more or less increase in the size of the organ. The liver was enlarged in all but one of our cases. It was enlarged both upwards and downwards, although it was sometimes difficult to map out the upper border of the organ with certainty in the presence of a subphrenic abscess or of fluid in the pleural cavity. The lower border of the liver was enlarged downwards in 17 of the 18 cases, and in all but two of these it was plainly palpable. Perthes,[29] speaking of the tropical abscess, says that even with an abscess of considerable size in the right lobe there may be no enlargement

downwards, while Kiefer,[30] from his large experience, declares that enlargement downwards is not the rule. The only explanation that I can offer for the difference between the abscesses we have observed and those described by the above-mentioned writers, is that in tropical abscess enlargement of the liver is not as frequent as in the abscesses here reported. The upper level of liver dulness is usually a curve, with its convexity upwards, which does not change with change in the patient's position. This convexity is, however, wanting when there is fluid in the pleural cavity.

Fever was present in every one of our cases. It usually ran an irregularly intermittent course, and in 9 of the 18 cases was accompanied by chills or chilly sensations and sweats.

A marked and rapid loss of flesh and strength was one of the chief complaints in 11 out of 16 patients. It was not unusual for the patients to have lost from ten to twenty pounds in one or two weeks.

Cough without or with slight expectoration was noted in 6 of the 18 patients (30 per cent.).

Jaundice occurred only twice among the patients, although most of the patients had a characteristic sallow, yellowish color. In this connection it might be mentioned that excepting in the two patients with jaundice above mentioned, we have never been able to find bile in the urine. Wendel,[31] however, declares that he always found bile pigments in the urine in tropical abscess.

In every one of our cases in which a white blood-count was made, there was a leucocytosis—the smallest number of white cells in the cm. was 8100, and the largest, 34,500.

Diagnosis.—The greatest difficulties in diagnosis are encountered in the effort to differentiate between a single abscess and multiple abscesses, between liver and subphrenic abscess, or liver with subphrenic abscess. In many cases the differential diagnosis is impossible before the operation; a pleurisy with effusion or empyema and a subphrenic abscess may be recognized, while the underlying cause of the con-

dition—the hepatic abscess—remains unrecognized. The first point to determine is whether the affection is above or below the diaphragm or whether there is disease in both these regions—in other words, is there a pleural effusion alone, or a subphrenic or liver affection alone, or are both combined? The physical signs of pleurisy with effusion and of empyema need not be described here; mention will be made of only a few signs that are of diagnostic value. With a beginning pleural effusion there are more apt to be symptoms which point to an affection of the chest,—rapid respiration, cough, expectoration; the level of the dulness is generally concave upward, and the upper border of the dulness changes distinctly with a change in the position of the patient.

When there is a well-marked effusion under the diaphragm there are usually few or no thoracic symptoms; the upper level of the dulness is a straight line, or is convex upward, there is little change in the line of dulness with a change in the position of the patient. In pleural effusions the respiratory murmur is much diminished or absent below the level of the fluid, while in subphrenic or hepatic abscesses the murmur can generally be plainly heard below the level of the fluid. The heart is never appreciably pushed to the right. The greatest difficulties in diagnosis are met with in the cases in which a pleurisy with effusion is associated with a collection of pus underneath the diaphragm in the liver or in the subphrenic region. When the subphrenic abscess contains gas, the diagnosis of the two associated conditions is possible. In the upper part of the chest there are then the signs of pleuritic effusion, and below these the signs of an effusion containing gas. When the quantity of fluid in the pleural cavity is considerable, it may be impossible to make the diagnosis of a primary subphrenic abscess, or subphrenic secondary to liver abscess, or of primary liver abscess, except from a careful study of the patient's history and by means of the aspirating needle. If pus is withdrawn by aspiration through one of the lower intercostal spaces and clear fluid by aspiration higher up, the diagnosis of an association of two conditions is almost assured.

We have not found Litten's diaphragm phenomenon of much diagnostic significance, for it can be found to be present in many normal individuals.

According to Fuerbringer,[32] the motions of an aspirating needle introduced into the abscess are pathognomonic. Fuerbringer claimed that during inspiration and expiration an exploring needle which had been introduced to below the diaphragm would move in the opposite direction to what it would do if it were in the pleural cavity. The movements of the diaphragm are often greatly impaired, especially when the diaphragmatic is adherent to the costal pleura and the costophrenic sinus obliterated. We have found this sign, however, of considerable value when it was present.

Localized œdema of the chest-wall, if present, is of importance, since it shows that the abscess is approaching the surface of the body.

The differential diagnosis between subphrenic abscess and abscess of the liver is very difficult and often impossible. In both affections the liver dulness is increased upwards and downwards and limited above by the diaphragm; in both is the lowermost level at which the respiratory sounds can be heard below the level of dulness; the clinical symptoms of hepatic abscess may be in all respects like those of subphrenic disease, or the latter is present secondary to a liver abscess.

As I have already shown, solitary abscess of the liver after appendicitis is rare as compared with subphrenic or multiple hepatic abscesses. Accompanying disease of the pleura (serous, sero-purulent or purulent effusion) is more rare in hepatic abscesses than in those in the subdiaphragmatic region. (The pleura were the seat of secondary inflammation in about 50 per cent. of the cases of subphrenic abscess collected by the writer.) For a number of other facts of diagnostic value for the differentiation between subphrenic and liver abscess the reader is referred to a paper on subphrenic abscess published a few years ago (ANNALS, December, 1901).

The differential diagnosis between solitary and multiple

abscesses of the liver is impossible in many if not most of the cases, although sometimes a careful consideration of the etiology and the course of the disease may result in the making of a correct diagnosis. Appendicular disease and affections of the gall-bladder and bile-ducts are more apt to be followed by multiple hepatic abscesses. The presence of fluctuation in the intercostal spaces or in the hypochondrium points rather to solitary abscess. Enlargement of the spleen occurs more often in multiple abscesses. Multiple abscesses of the liver are very apt to give marked symptoms early when the suppurating areas are still small, so that in a case where all of the symptoms and signs pointed to suppuration in the liver, negative results of repeated aspirations should make one think of the greater probability of multiple abscesses. Although there may be a well-founded suspicion that there are numerous abscesses, the patient should always (if the general condition permits it) be given the benefit of the doubt and operative interference be instituted as soon as pus has been found by the aspirating needle. Although, in a very few cases, a cure has followed the drainage of a number of abscesses of the liver, the presence of multiple abscesses is usually a fatal complication.* The danger from repeated aspirations of the liver, however, is not very great if one is prepared to follow at once with the operative interference.

There are several other conditions with which abscess of the liver may be confused, and which must be mentioned here. The differentiation of simple abscess from suppurating echinococcus cyst may be impossible until pus has been found with the aspirating needle and the characteristic hooklets have been found in it by the microscope. A previous history of liver

* In the cases of this kind, there were usually two or three large abscesses which were successively opened and drained. There is to the best of my knowledge not a single case on record where recovery has resulted in the presence of innumerable large and small abscesses scattered over both hepatic lobes, as are found in most cases of multiple abscesses of the liver.

tumor which has existed for many years before the onset of the present symptoms, may be of diagnostic value.

Metastatic carcinoma of the liver may cause enlargement and tenderness of the organ and is often accompanied by an irregular intermittent fever. During the past year there have been two patients on the Second Surgical Service at Mt. Sinai Hospital with metastatic carcinoma of the liver,—secondary to malignant disease of the rectum in the one case, and of the breast in the other. Both patients had enlarged and tender livers and for a number of weeks an irregular fever of between 100° and 104°. A history of preceding malignant disease in some other part of the body, or its demonstrable presence, a hard palpable tumor of the liver, cachexia, and the absence of a marked increase of polynuclear leucocytes in the blood, are of diagnostic value. The differential diagnosis can usually be made without recourse to the aspirating needle. The diagnosis of gumma can usually be made from the history. Other conditions that may have to be differentiated from abscess of the liver are malarial fever, intermittent hepatic fever due to infective cholangitis, abscess of the spleen (when the hepatic abscess is in the left lobe) and, rarely, large abscess of the kidney.

Prognosis.—The mortality after operations for solitary abscess of the liver is not as large as one would expect in view of the serious nature of the disease and the importance of the organ affected. Of the eighteen patients in our series five died (28 per cent.). Kieffer [33] believes that if the patients come to fairly early operation, 90 per cent. should recover.

Most operators have a mortality of between 20 per cent. and 50 per cent., although Smits [34] saved 18 out of 21 patients by early operation. Of 182 cases collected by Perutz [35] 44 died, a mortality of 24 per cent. From the cases we have seen we have gained the impression that the prognosis of amebic abscess of the liver occurring in temperate zones is not as good as the prognosis in single abscess associated with the presence of other organisms.

Treatment.—Whenever, after an acute abdominal affection, in which the local symptoms have been relieved, there are chills, intermittent fever, and rapid emaciation, it is important to examine the liver very carefully from day to day and to keep the possibility of a suppurative process in that organ in mind. As soon as the signs justify aspiration of the liver, this should be done, and when pus has been discovered, there should be no delay before operation is done. In rare cases, the symptoms and signs of liver suppuration may be so clear, and the rapid deterioration of the patient's condition so evident, that even when repeated aspirations have resulted negatively, an exploratory operation is justifiable. The following case of this nature is of sufficient interest to be reported in detail in this place:

Rebecca R., 32 years of age, was admitted to the Second Surgical Service of Mt. Sinai Hospital, on July 5, 1904. Twelve hours before, the patient had received a bullet-wound in the upper part of the right chest. It had been supposed by the physician who saw her at the time that the wound was only a superficial one. As her general condition was becoming steadily worse, she was brought to the hospital.

On admission, she was almost in collapse; the pulse was very small and rapid; the tongue dry and coated; just above the right breast in the fourth intercostal space was a small punctured wound with a large area of ecchymosis around it. The abdomen was generally distended and tympanitic; everywhere tender and rigid, but the rigidity and tenderness most marked in the epigastric and left hypochondriac regions. There was a normal area of liver dulness, but there was some movable dulness in the left flank.

The patient complained of severe cramp-like pain in the upper part of the abdomen but she could not localize it on one or the other side.

On the suspicion of an abdominal injury, she was at once taken to the operating-room for operation (Dr. Elsberg). Under ether anæsthesia the point of entrance was first carefully probed. The probe passed downwards and to the left to the lower part

of the sternum, where the bone was found to be bare. An incision was made at this point, and it was then found that the bullet must have passed downward into the abdominal cavity.

The abdomen was then opened by a median incision above the umbilicus. When the peritoneum was incised, a large quantity of dark blood escaped, together with a little gas. On the under-surface of the left lobe of the liver was a large irregular lacerated wound from which there was a continual oozing of dark blood. The wound was packed with gauze, and opposite it on the anterior wall of the stomach was a perforation of that organ about one cm. in diameter from which fluid stomach-content was escaping. The perforation was closed by a double layer of Lembert sutures. The lesser peritoneal sac was then opened by an incision along the greater curvature of the stomach. The lesser sac was clean, nor did careful examination of the posterior wall of the stomach reveal a wound in its wall. There was a large collection of blood around the lower part of the kidney.

The patient was, at this stage, in such poor condition, that further interference was considered contraindicated; the liver wound, the suture line on the anterior wall of the stomach and the region of the left kidney were drained with gauze, the abdominal cavity carefully sponged clean, and the greater part of the abdominal wound closed by layer sutures. The wounds in the chest-wall were drained. The patient was removed to her bed with a pulse of 180, but she improved rapidly under energetic stimulation.

From this time up to July 23 the patient steadily improved; the temperatures varied between normal and 101°, the pulse between 100 and 120. The wounds healed up slowly, with but little discharge.

July 23.—Severe chill followed by temperature of 104° and pulse of 140; few friction sounds over left base behind; leucocytes 17,000.

July 24.—Dulness from spine of scapula to base of left lung behind, with bronchial breathing, and almost absent voice and fremitus; aspiration of left chest negative.

July 26.—Rapid pulse has persisted with intermittent high temperatures; almost daily chills; physical signs over lower part of left chest the same as when last noted except that dulness now

extends to middle of scapula behind; clear fluid, withdrawn from left of chest with aspirating needle, was sterile on culture.

August 4.—The patient's condition has grown steadily worse, high temperatures and rapid pulse persist; the signs over the lower part of the left chest the same as when last noted; the patient is much emaciated; there are irregular chills with sweats; leucocytes 23,800. The left lobe of the liver is slightly enlarged downwards and is tender. The left lobe of the liver was aspirated almost daily but no pus could be found. X-ray showed the bullet between the ninth and tenth ribs behind, probably in the left subphrenic region.

August 6.—In spite of active stimulation, the patient is very weak to-day; she had a severe chill this morning, after which the pulse was almost imperceptible for several hours. The left lobe of the liver and left subphrenic region were aspirated in all directions, but the results were negative.

As the patient seemed almost moribund, and because of the probability of suppuration around the region of the bullet, it was determined to do an exploratory operation as a last resort. Under a light chloroform anæsthesia, three inches of the ninth rib on the left side were resected, the diaphragm exposed by pushing up the reflexion of the pleura, and the left lobe of the liver aspirated; the first aspiration withdrew thick grey pus. The diaphragm was then incised and the liver again aspirated. This time yellow pus was obtained. With the needle as a director the abscess of the liver was opened with a grooved director and dressing forceps and about two ounces of yellow pus evacuated. On account of the different character of the pus obtained at the first aspiration, the left subphrenic region was again aspirated, thick grey pus obtained, and a small subphrenic abscess opened and drained. By this time the patient was in very poor condition, so that no search could be made for the bullet. The abscesses were drained and the patient put upon energetic stimulation.

On the following day the patient's condition was much improved and the improvement thereafter was a slow but continued one. The temperature and pulse reached the normal after one week; she began to gain flesh and strength rapidly. Thirteen days after the operation the bullet was felt with a probe introduced into the sinus leading into the left subphrenic region, and after some difficulty was removed. It was of 38 calibre.

December 16.—The patient has gained 40 pounds in weight, all wounds are healed and on this day she was discharged from the hospital cured.

Cultures from the pus withdrawn from the abscess of the liver contained the streptococcus.

Remarks.—The interesting feature of this case, aside from the severe nature of the injuries and the recovery of the patient, was the fact that repeated aspirations were never able to find the pus in the left lobe of the liver and the left subphrenic region, although the physical signs, the presence of fluid in the left chest, and the probable location of the bullet by the X-ray in the left subphrenic region, pointed to an abscess in that location.

The exposure of a lobe of the liver and the adjoining subphrenic region can be made by one of two routes,—either by transpleural or infrapleural thoracotomy, or by an abdominal incision through the right or left rectus muscle. The abdominal operation must be retained only for those cases in which the symptoms and signs point to an abscess approaching the under surface of the right or left lobe of the liver, and in those in which there are mainly abdominal symptoms.

In the large majority of the cases, however, the abscess is located in the upper part of the liver and had best be approached through the wall of the chest. The technique of infrapleural or transpleural thoracotomy will not be described here, as the writer has described the typical operation in detail in a paper on subphrenic abscess (ANNALS OF SURGERY, December, 1901). I desire, however, to again lay stress upon one point in the technique of the transpleural operation which seems to me of great value, but which as yet has not been given the prominence it deserves.

In the transpleural operation (if the costo-phrenic sinus has not become obliterated by adhesions) the suture of the diaphragmatic to the costal pleura after the incision of the latter can often not be accomplished without the entrance of more or less of air into the pleural cavity. By means of upward

pressure against the liver, however, it is usually possible to so closely approximate the diaphragmatic to the costal pleura that little or no air can enter the pleural cavity when the pleura is incised and while the two layers of the pleura are being united by suture. The writer has found this method of great value in preventing an acute pneumothorax where there are no adhesions.

When the diaphragm has been incised, and there are no adhesions between it and the liver, the peritoneal cavity must be carefully walled off on all sides by gauze packings (which must be allowed to remain undisturbed for six to ten days after the operation). The liver is then aspirated and when the pus has been located, a grooved director is pushed into the abscess along the needle, the canal dilated with dressing forceps, and the abscess drained according to general surgical principles. If the abscess is deeply situated in the lobe of the liver, it may be advisable to use the actual cautery on account of the danger of hæmorrhage. In most instances the careful dilatation with the dressing forceps is all that is required.

When the abscess has burst into the subphrenic region, all that is necessary is to drain the subphrenic space after having made sure by digital exploration that the opening into the liver abscess is large enough to allow of free drainage. The liver has often to be drained separately with a large tube.

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THE TREATMENT OF GASTRIC AND DUODENAL ULCERS AND BENIGN OBSTRUCTIONS OF THE PYLORUS.[1]

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THE question, how may we distinguish between the medical and surgical gastric ulcer, is of the greatest interest. We know that some ulcers cure themselves, for we find the scars at post-mortem examinations, where the patient has not given any history of gastric ulcer. Many ulcers give no symptoms, as is shown by the large number of perforations occurring in patients who have never had dyspepsia. One such case came to my knowledge. A friend of mine made the post-mortem examination and found a large perforated gastric ulcer on the anterior gastric wall. Shattuck says that "there are only two conditions occurring in gastric ulcer which demand operation: first, perforation; second, obstruction." We will all agree regarding the propriety of operating upon perforation cases. Here, if the perforation is due to an acute ulcer, and the opening can be closed, the wound sponged or irrigated, and a large-sized supra-pubic drain put in soon after the perforation occurs, a large percentage will recover, with the aid of the Fowler position. My own experience makes me feel that gastro-enterostomy in acute perforations is harmful, and the three cured cases who have had no return of their symptoms in over three years make me feel that it is unnecessary. In subacute or chronic perforation a gastro-enterostomy may in some cases be a wise procedure.

We can also all agree regarding the obstruction cases,

[1]Read before the American Surgical Association June 1, 1906

whether it be in the congenital obstruction of infants, or obstructions by bands or from inflammatory tumors accompanying chronic ulcer of the pylorus; these conditions are mechanical and demand mechanical relief. The congenital contraction presents a difficult problem, for, before the diagnosis is made, the infant is usually starved to the verge of exhaustion, and its normal resistance, which at best is poor, is further lessened by the disease.

Then, again, according to Scudder, one-third of these patients recover under proper diet. The spasm or contraction relaxes and the child outgrows the obstruction. In speaking of patients who recover without operation, one is apt to confuse true congenital hypertrophy of the pylorus with some similar condition which resembles it. As Mr. Edmund Cantley says, "I have seen several supposed cases get well without operation, but in no one of them did I agree with the diagnosis. On the other hand, I have no doubt that a mild degree of the condition can exist without proving fatal, for of this we have distinct evidence in the cases seen in older children. Yet of 15 cases which have come under my notice, all have been verified at operation or post-mortem examination. Only two of the last ten have been treated by purely medical measures, and both succumbed."

Scudder also makes the surprising statement that from the statistics of operated cases 50 per cent. recover. I have recently seen two of these little sufferers with Dr. Ramsey, of St. Paul. Both had a pylorus which was practically closed. One died from exhaustion following a gastro-enterostomy by Dr. Goodrich, of St. Paul. The other died without any operative relief, the child's condition when he reached the hospital being so bad as to make it certain that he would not stand any operation, Before death we could distinctly see the peristaltic waves or contraction, slowly passing from left to right across the child's emaciated abdomen. A post-mortem in each case showed a slightly-dilated stomach, with a pyloric opening contracted to the

size of a small probe by an extensive hypertrophy of the walls of the pylorus; on section showing a thick, white, fibrous band about one mm. in thickness and almost one-half inch in width.

It seems to me that there should be at least one other class added to this list,—*i. e.*, relapsing gastric ulcer, as suggested by Dr. Chas. Greene and others. How many relapses, would be an individual question. The nine complete and permanent cures facetiously mentioned by Haggard would certainly be an outside limit. That many of the chronic ulcers, with and without hæmorrhages, do recover after proper medical treatment, I know from my own observations. The statement that we often hear at the operating-table, that this patient has had three, four or more medical cures, is not sufficient; most medical treatment is a farce. The prescribing of pepsin, pancreatin, peptinzyne, papoid, and similar medicines, is useless and absurd. If there is any foundation in the theory that gastric and duodenal ulcer is due to hyperacidity, then the use of large doses of alkalis one-half hour after meals would be a rational line of treatment. In questionable cases when we suspect gastric erosion or a commencing ulcer, large doses of bicarbonate of soda and bismuth have seemed to me of considerable benefit, in temporarily, at least, relieving gastric pain. As a remedial agent the stomach-tube is of little value; it is of the greatest aid in diagnosis, and in a few middle-aged patients, with impaired digestions due to deformed or slightly crippled stomachs caused by the contractions of a healed gastric ulcer, the occasional use of the stomach-tube gives considerable relief (Graham).

Proper medical treatment consists in putting the patient to bed and taking away all food by the mouth from four to six or more days, or until all tenderness on pressure over the stomach has disappeared; supplying water and nourishment by the rectum. In 90 per cent. of these cases a week's starvation will prove sufficient; then we may commence with liquid foods and in two or three days we can

add baked potatoes, well-cooked rice and breakfast foods, spinach and the lighter vegetables. Most of these cases will have to be careful of their diet for months, but so will surgical cases, for that matter; very few gastro-enterostomy patients can be careless about their diet without suffering ill effects.

I have been surprised at the number of fairly permanent cures which have followed the above line of treatment. Some of them no doubt relapsed and have gone to some one else for an operation, but most of them I have been able to keep track of and know that they were quite well for long periods of time. The cases which were not relieved and who commenced vomiting again have usually proven to have a benign stricture of the pylorus, open chronic ulcer, or gastric adhesions. Inflammation of the gall-bladder may cause adhesions of the duodenum or pylorus, and these will produce painful digestion or true obstruction. Adhesions of the body of the stomach by the interference with the normal movements of the organs may produce great disability. One of my patients upon whom I had performed a posterior-no-loop-suture gastro-enterostomy was recently reoperated upon after an interval of one year, to find that the anterior wall of the stomach was densely adherent to the abdominal incision; the pylorus was open, and the gastro-enterostomy opening had not contracted. When she tried to get up and do even the lightest work she vomited as badly as before her operation; when she was put to bed she could take and retain light foods. The separation of this adhesion, one and one-half inches long by one inch wide, with scissors,—the suturing of the raw surface and the covering of the suture lines by a piece of omentum, relieved her of her stomach distress.

One of the greatest difficulties in dealing with these stomach cases is to distinguish between true chronic ulcer and the neurasthenic cases which they so closely resemble; careful watching for some period of time will often be neces-

sary to distinguish between the two. I am always suspicious of the case when the operator does not find any evidence of gastric ulcer at the time of operation. Of course there may be gastric erosion or fissure producing spasmodic closure of the pylorus, but such cases are medical and not surgical as a rule, and I speak from personal experience when I say that the patients are not improved by gastro-enterostomy. I have one such case of my own, and I have seen several operated upon by others, who were worse rather than better as a result of gastric surgery. Gastro-enterostomy has been and still is the operation most frequently done for all sorts of gastric diseases; the posterior-no-loop operation as assembled by Moynihan and last described by Mayo is by far the best operation so far proposed; it is sound in its mechanics, easy and safe in competent hands. The various operations for drainage of the stomach which have served their usefulness and have now been discarded are the anterior-long-loop, button and suture operation, which are now used in exceptional cancer cases. Mr. Patterson and Mr. Battle think that the popularity of the posterior operation is due to fashion, and that the anterior operation has advantages which will bring it back to favor. My observation is that the dragging of the heavy anterior loop causes the contraction of the opening and a relapse of the obstructive symptoms.

A few years ago we heard a great deal about the necessity of closing the pylorus after a gastro-enterostomy. This necessity has in a great part disappeared since the posterior operation has taken the place of the anterior. The Finney operation has a very limited field; the Roux operation, although effective, is not necessary if the loop is short enough, and the mortality is greater because there are two intestinal openings and suture lines instead of one. But as an operation gastro-enterostomy has been overworked. Dr. Rodman tells me that he found many reported cases of perforation and fatal hæmorrhage following gastro-enterostomy; many due no doubt in large part to faulty opera-

tions, where the anastomosis has been followed by kinking or twisting of the intestine and consequent water-logging of the duodenum. My experience in surgery of the stomach has not been great. Although I have seen a large number of questionable cases, I have avoided operating when possible because the permanent results until the past two years have not been satisfactory and the result of medical treatment has been fairly good. I have lately operated upon 30 cases, the last 15 without a death.

The operation of the future will undoubtedly be some form of resection. In many of the cases now treated by gastro-enterostomy, in chronic ulcer of the pylorus without obstruction, and in hour-glass stomach, resection is especially applicable.

VOLVULUS OF THE SMALL INTESTINE IN TYPHOID FEVER, SIMULATING PERFORATION.*

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A GIRL, aged 19 years, in the Polyclinic Hospital, under the care of Dr. David Riesman for typhoid fever, had been admitted on February 9th, and showed the usual symptoms of that disease.

At 9 P.M. on the 22d of the month she began to complain of abdominal pain of a severe character, which persisted throughout the night. On the next morning the patient was listless, with contracted pupils and parted lips; and had a temperature at 2 A.M. of 103.4°; at 8 A.M. of 102.4°. The pulse had not varied much from what it was before the pain occurred, but her respiration was increased. The breathing was mostly abdominal in type. There was slight fulness in the lower right quadrant of the abdomen and extreme tenderness in that region, with marked rigidity and some dulness and impaired resonance. The pain was most marked at McBurney's point. At intervals the resistance lessened. There was no tenderness in the right flank posteriorly. The pulse was of good volume but dicrotic. The liver dulness was preserved and extended to the costal margins. The heart sounds had good tone and were normal. The tongue was dry and could not be readily protruded. At 11 o'clock in the morning of the 23d, tenderness and rigidity were more marked than at 10 o'clock.

When I saw her on the 23d at 11.30 A.M. the whole abdomen was rigid, but the rigidity was much more marked in the right iliac region. There had been no sudden drop in temperature, though in the preceding thirty-six hours the temperature had come down about three degrees and there had been a slight increase in pulse and respiration. At the time of the examination, however, the condition of pulse, respiration and temperature was about that which had existed prior to this gradual

*Read before the Philadelphia Academy of Surgery, April 2, 1906.

fall in the temperature. The patient was crying out at intervals from pain, and gave evidence of great pain when the skin over the right iliac region was even lightly touched. This occurred even if her attention were distracted from her abdomen, by asking her to put out her tongue. The general symptoms of perforation were not present, but the pain, tenderness and rigidity seemed to indicate some intra-abdominal lesion.

An incision, about three inches in length, was made over the ileocæcal region. No pus or serum was found in the abdomen. There was great difficulty in drawing up the cæcal portion of the ileum, which seemed to be imprisoned in the pelvis and was collapsed. The ileum, above the portion held in the pelvis, was moderately distended, freely movable, and easily delivered through the wound. The appendix was short and bound, throughout its whole length, to the cæcum by a web-like attachment, and pointed upwards. It was not swollen nor inflamed externally, and no concretion could be felt within it. The condition of the appendix seemed to me to be more like a congenital anomaly than a condition due to old inflammatory adhesions. There was no perforation in the appendix or cæcum. After a good deal of difficulty the lower portion of the ileum was pulled up from the pelvis and drawn out of the wound, when it became normally distended. There were no evidences of its having been held by adhesions. About two feet of the ileum, from the cæcum upward, were examined and no perforation found. There was no discoloration of the serosa to indicate the presence of internal ulceration. The gall-bladder was examined, but found normal to touch. It was moderately distended and contained no calculus. The incision was closed, and subsequently healed by first intention.

The patient's pain and the rigidity of the abdomen disappeared after the operation. She went through the remainder of the typhoid fever without abdominal symptoms other than such occasional pain as might be seen in ordinary cases. There was no later evidence that there had been an appendicitis to have been the cause of the pain and rigidity. The slight rigidity and pain, which were subsequently complained of, seemed to be very different from what was present at the time of the operation, and could readily be accounted for by the ordinary nervous condition of the patient. When convalescence seemed almost

complete, the patient had a relapse, with comparatively high temperature and an enlarged spleen. From this condition, she gradually recovered.

Consideration of this case seems to show that there was either a volvulus causing constriction of the lower portion of the ileum, or a mild appendicitis, due probably to a typhoid inflammation of the mucous membrane. Because of the critical condition of the patient from typhoid fever, the absence of definite symptoms of appendicitis and the possibility of the condition of the appendix being congenital, the appendix was not removed.

I have come to the conclusion that the symptoms were due to a sudden twist of the ileum, which was finally disentangled, when I turned the coils over and over, in my endeavor to bring the cæcal end of the small intestine up from the pelvis, in which it was imprisoned.

Dr. Riesman writes me that "taken all in all, I agree with you that volvulus or perhaps a localized spasm of the intestine was the cause of the girl's symptoms, which brought her to the operating-table."

The situation of the appendix was very like that shown in Figure 252 of Kelly and Hurden on The Vermiform Appendix and Its Diseases. It is labeled by those authors, "Embryonic Displacement of the Appendix." In this instance, which I am considering, the appendix was much shorter, but it pointed upwards and was similarly adherent to the cæcum.

Had I not found the bowel held down in the pelvis so firmly, I should have been driven to the conclusion that the symptoms were due to an attack of mild appendicitis, which promptly subsided, as not infrequently happens in that disease unassociated with typhoid fever. The woman states that she never had a similar attack of pain or other evidences of appendicitis. I have watched her carefully since operation, and have found no reason to believe that an appendicitis has been present. The operation

seemed to exert no influence on the course of the typhoid fever; except to relieve the abdominal pain and rigidity. Intestinal obstruction in typhoid fever from volvulus or other cause appears to be unusual At all events its occurrence has not attracted the attention in literature that its importance demands. This may be due to the fact that many cases have been considered to be fatal perforations of the bowel. If no operation or necropsy was performed, the true condition would remain unrevealed.

Dr. Allan Eustis,[1] in a paper read March 11, 1905, before the Orleans Parish Medical Society, records two cases of fatal volvulus of the small intestine, occurring in typhoid fever. He believes that cases occur which are mistaken for perforation of, or hæmorrhage into, the bowel. In his cases the diagnosis was only made by autopsy, and it is probable that in both instances prompt operation would have saved life. The symptoms, according to Dr. Eustis, closely simulated those of perforation, excepting that the leucocytosis was not so high. He says that a localized paresis of the bowels favors the occurrence of volvulus, as does also absence of mesentery in the lower end of the intestine. He thinks that volvulus might occur in cases recovering from typhoid fever, on account of the localized peritonitis so often seen in this disease; and quotes Mayo Robson as mentioning the occasional occurrence of volvulus during colic from cholelithiasis.

DR. EUSTIS'S CASES.

Case I.—A colored woman, aged 22 years, with typical symptoms of typhoid fever, for six and a-half weeks, was seized with violent abdominal pains, referred to the umbilical region, followed by violent and persistent vomiting. The morning temperature had been normal for 15 days, while the afternoon temperature reached 99° or 99.5°. The pain was accompanied by extreme collapse, subnormal temperature and imperceptible pulse. When seen by Dr. Eustis a few hours later her temperature was 97°, the skin cold and clammy, and the pulse imperceptible. She was vomiting almost incessantly and passing loose green

[1] New Orleans Medical and Surgical Journal 1904-1905, vol. lvii p. 816.

stools with an offensive odor. The abdominal walls were rigid and palpation was extremely painful. There was very little tympanites. No mass could be felt through the abdominal walls, on account of their rigidity. The leucocytes numbered 15,000. She died within a few hours, notwithstanding the use of stimulants and external heat.

Post-mortem examination of the abdominal cavity disclosed a volvulus of the middle of the jejunum. The intestine here was intensely congested and almost gangrenous, and was matted down at the site of the volvulus. The mucous membrane from the ileocæcal valve to beyond the region of the volvulus showed ulcerations of the Peyer's patches. In some places the ulceration had almost extended to the serous coat of the intestine.

Case II.—About ten days later a similar case was seen by him. It presented the following history: A colored girl, aged 15 years, was admitted to the Charity Hospital on July 22, 1903, in a delirious condition, which prevented the obtaining of a definite history. There was severe abdominal pain which persisted until death. The abdomen was moderately distended, tympanitic and extremely tender to pressure. The extreme prostration of the patient was overcome to some extent by stimulation until three days after admission, when she was seized with excruciating pain in the abdomen, accompanied by subnormal temperature. Vomiting occurred immediately and soon became stercoraceous. Diarrhœa with offensive stools succeeded the constipation which had been present for some days after admission. Cold, clammy skin, imperceptible pulse, and subnormal temperature occurred, and she died on July 27th without rallying from the initial symptoms of shock.

The intestines were found congested, and the solitary follicles and a few Peyer's patches were ulcerated. No perforation was found, but the intestines were matted together by recent adhesions. Four feet above the ileocæcal valve the adhesions formed a flexion about four inches in length producing an obstruction at this site, and there was distinct twisting of the involved intestine. Dr. Eustis believed it probable that both patients could have been saved by prompt surgical interference.

Duliscŏuet reports a case of laparotomy for the treatment of intestinal perforation, occurring during convalescence from typhoid fever, in which four days later a second abdominal section was required because of twisting of an intestinal loop.[1]

I have not been able to obtain the original article in time for incorporation in this paper. The double operation was followed by recovery of the patient.

J. Vincent reports a case of intestinal invagination

[1]Anjou méd. Angers, 1899, vi., 193.

during convalescence from typhoid fever.[1] At the end of nearly seven weeks the man was suddenly seized with abdominal pain and vomiting. Up to that time the typhoid fever had shown nothing unusual, and was of moderate severity and devoid of special symptoms. The diarrhœa had disappeared, and the patient had been free from fever for about two weeks. The man showed depression and complained of a little dull and diffused abdominal pain, with occasional colicky attacks. Below the navel and especially above the pubes marked pain on pressure was present.

Vincent was uncertain whether intestinal obstruction or perforation existed. Necropsy disclosed an invagination of the jejunum about 30 centimetres below the duodenum, which completely obliterated the lumen. The invagination was downwards and about 5 to 6 centimetres of bowel were engaged. At a point below, a second invagination was found, but here the obliteration of the calibre was not complete. The typhoid lesions were cured and showed no trace of cicatricial contraction or ulceration.

In Dunglison's College and Clinical Record[2] is mentioned a case of chronic obstruction of the bowel occurring in a man who had had typhoid fever seven years previously. He suffered at the time of the fever with peritonitis and seemed to recover perfectly, but a year later he was seized with an attack of obstinate constipation. Dr. James C. Wilson, who showed the man at his clinic in Jefferson Medical College, stated that such attacks had continued to happen at intervals of eight or ten weeks. Vomiting would occur, and finally the throwing up of great quantities of food mixed with fæces relieved the symptoms until a similar attack took place a few weeks later. The voided matter was a large, irregular mass, showing the appearance of having come through a small aperture and then being

[1] Archives de médicine et de pharmacie militaires, 1895, xxv., 400.

[2] Philadelphia, 1898, xix, 219.

coiled upon itself to form a large accumulation. Surgical operation was advised.

G. Harrison Young[1] reports an extensive chronic contraction of the ileum due to typhoid ulceration occurring two and a-half years before. It had caused no symptoms until sudden obstruction occurred after a jolt on horseback. The patient died eighteen days later with symptoms suggestive of a second attack of typhoid fever. Examination showed great contraction of the lower twenty-two inches of the ileum, with enormous dilatation above this region. The stricture was due to two bands, in the submucous tissue, believed to be due to old typhoid ulcerations. There were old cicatrices of the mucous membrane; and four recent ulcers in the ileum, one of which had perforated. There was also a perforation in the cæcum. The reporter did not believe the fatal ulcerations to be typhoid in origin.

Drs. R. H. Harte and A. P. C. Ashhurst mention[2] a case of peritonitis in typhoid fever due to intussusception.

August Hölscher, of Wiesbaden, in a study of the complications in 2000 cases of fatal typhoid fever examined in the Pathological Institute in Munich, mentions that ileus, or twisting of the intestines, was found in three cases.

It is probable that an extended search would show other reported cases of intestinal obstruction, happening in connection with typhoid fever and being responsible for its fatal termination. Enough has been said, however, to convince the thoughtful that acute abdominal crises in this fever should be sufficient warrant for prompt exploratory incision. The innocuousness of such operations skilfully performed, even in the course of this debilitating disease, has been fully established.

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[1] Medical Press and Circular, December 1, 1886, p. 471.

[2] Annals of Surgery, January, 1904, p. 23.

MYOFIBROMA OF THE LARGE INTESTINE.[1]

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TRUE Myofibroma, that is to say, tumors which may be classed strictly as, 1, Leiomyomata; or 2, Rhabdomyomata of the large intestine, are practically unknown. Tumors involving the large intestine are usually fibromyomata, and the muscular elements they contain put them, with very rare exceptions, under the class Leiomyofibromata. These tumors are found most frequently about the rectum. A few cases on record have affected the colon and cæcum. The sigmoid flexure is very rarely involved.

The literature of myomata of the large intestine is very meager. E. Lexer, in Verhand d. Deutsch Gesellsch. f. Chirurg., XXI, Part 2, pp. 440–446, gives the best summary of cases and discussion of the subject I have seen. He divides myomata of the large intestine into three groups, as follows:

(Group *a*.) Tumors which develop in the lumen of the gut. These tumors appear as roundish or polyp-like tumors; they are pedunculated, covered by mucous membrane, and are of rather a hard consistency. These are found usually in the rectum; microscopically they are fibromyomata. They may usually be removed by way of the anus by ligating and cutting through the pedicle. Lexer collected six cases of this variety, one reported each by Tedenal, Carlein and Heurtaux, two reported by König, and one by Caro.

(Group *b*.) Tumors which develop from the outside walls of the intestine, also more or less pedunculated; these impinge on the lumen of the intestine by pressure on account of their bulk; they involve usually the upper part

[1] Read before the American Surgical Association, May 30, 1906.

of the rectum or lower sigmoid. They must be removed by a laparotomy. Three cases are given under this group, namely, one each by Senn, Westermark and Pfannensteil, the latter a double tumor.

(Group *c.*) Tumors which develop from the rear of the rectum, which by their growth fill up the cavity of the pelvis. They must be removed by sacral exsections or parasacral incisions. Three (3) cases are given under this group, one each by Berg, McCosh and Lexer.

The tumors of the last two groups are difficult to diagnose and are usually mistaken for other growths.

Lexer credits Longuet ("Des tumeurs conjonctions benign du rectum," Le Progres Medical, 1898, S. 137) with the collection of six of these cases.

I have been able to collect a few other cases, reference to which will be found in the short bibliographical list appended to this paper.

These tumors are the true fibromyomata of the large intestine.

I have a case to relate which suggests the possibility of a fourth group, namely, inflammatory or hyperplastic myofibromata. While there can be no doubt that the tumor in my case was of inflammatory origin, it was a distinct circumscribed ovoid mass, uniform in development, symmetrical in shape, which produced by its growth and mass almost complete obstruction at its immediate location, and notably it was made up chiefly of muscular tissue, with fibrous deposits, and it was pronounced histologically a myofibroma. It was more than a hyperplasia. It was a tumor made up of mixed elements, but chiefly of myofibromatous tissues.

Obstructions of the large intestine by strictures which result from chronic inflammations not involving the mucous membrane are very rare, but there are several cases on record of this kind. I will mention these later on.

Willmanns (R.) in Beiträge zur klinische Chirurgie, 1905, XLVI, 221–232, published under the title "Ein Fall

von Darmstenose infolge chronisch entzündlicher Verdickung des Ileocæcal Klappe," a case of obstruction of the bowels on account of the thickening of the muscular layers at the ileocæcal valve. Rotter, whom I will quote presently, gives some cases of inflammatory strictures which involved the sigmoid. None of these cases, however, presented a distinct circumscribed mass which without involving the mucous membrane produced by its bulk and pressure nearly a complete obstruction of the bowels. My case seems, therefore, unique. The history of the case is as follows:

T. M. D., aged 62; married, American. Entered St. Luke's Hospital, November 10, 1904. His family history was unimportant. He had never been a robust man, but he had enjoyed fairly good health up to about seven years before this time. At this period,—namely, seven years before he entered the hospital,—he consulted me about some dyspeptic symptoms and obstinate constipation. Notwithstanding treatment his constipation became worse, and a tumor gradually developed in the left iliac region. This tumor was quite hard, slightly nodular, and seemed to be located between the sigmoid flexure and the left sacro-iliac synchondrosis; it was firmly fixed, not particularly sensitive to the touch, and seemed to be connected to the pelvic fascia rather than to the gut. Gradually fever and almost complete obstruction of the bowels developed. The tumor steadily increased in size without losing any of its hardness. Dr. John Da Costa, Sr., of Philadelphia, saw the case twice in consultation and concurred in the diagnosis of a hard tumor of the pelvis which caused occlusion of the intestine by pressure upon the walls. I thought the tumor was a sarcoma which originated from the neighborhood of the left sacro-iliac synchondrosis. Dr. Da Costa expressed no opinion as to the nature of the tumor, but agreed with me that it did not involve the lumen of the gut except by juxtaposition. Septicæmic symptoms finally came on, then a very large swelling which involved nearly the whole left iliac region developed; this soon became cystic and adhered to the anterior abdominal walls. These evident manifestations of pus were speedily met by an

incision below and about 5 cm. within the ant. iliac spine. A large quantity of most offensive pus and blood was discharged. A drain was introduced and daily washings-out were instituted. Improvement began at once, and the patient made a slow but apparently complete recovery, first from the septicæmia, then from the intestinal obstruction, and finally the *tumor entirely disappeared*. That the tumor did disappear there can be no possible doubt. I examined the patient repeatedly, Dr. A. T. Cabot, of Boston, examined him twice, once in the fall of 1897 (six months after the operation); he then thought he felt "a little hard mass about as big as the last joint of my thumb or possibly a little longer." At this time there were still some obstructive symptoms remaining, viz., irregular and sometimes difficult defecation, occasionally colicky pain, and a very decided tendency to bloating and intestinal distention. Dr. Shattuck, to whom Dr. Cabot sent him at this time, could not feel any tumor or thickening. Four months later there was absolutely no sign of a tumor and no symptoms of obstruction. Dr. Cabot examined him again and reported: "I examined him carefully, and certainly the little mass I felt at his last visit in October is no longer to be plainly felt. There is a little sense of resistance just inside of your incision, but no more, I think, than such an abscess as he had might have left. There is certainly nothing there now suggesting a new growth. The perfectly easy action of his bowels makes me think that there can be no real obstruction there at present." This states and sums up my own findings and opinion of his condition exactly.

For nearly six years he was in good condition and free from any tumor or symptoms of obstruction. Then gradually he began to have a return of his distention, and he had frequent belching, poor digestion, colicky pains, and increasing difficulty in having a bowel movement. This went on for about six months. During this time one could feel a slowly-growing tumor, which was oval in shape, quite movable, not sensitive to the touch, and which was located in the region of the sigmoid in the left iliac region. The feel was very different from, and its location was higher than, the first tumor, seven years before, and while the first tumor was quite fixed and undoubtedly to the outside of the rectum, this one was decidedly movable and seemed to be *a part of the sigmoid*. He had now a left inguinal hernia and a

very large ring which made it almost impossible to retain the hernia by a truss. Obstruction symptoms became progressively worse, until finally he had almost complete obstruction of the bowels. It was evidently necessary to resort to an operation for relief. He entered St. Luke's Hospital nearly seven years after his former "attack" and operation, and asked that the tumor be removed.

Condition When Admitted.—A rather pale, stout, flabby man of medium height. His lungs are normal, the heart action is rather weak, his heart muscle is decidedly below par, but the valves are good and the action of the heart is regular, the organ itself is enlarged, liver and spleen normal. The urine is normal. The abdomen is decidedly distended and he belches frequently. General tympany except over the course of the colon; the lower colon is quite dull. In the left iliac region there is a large oval mass just inside and a little below the anterior superior spine. This mass is hard, generally oval in outline, with its long axis directed obliquely downward and inward; it is movable and not tender to the touch. No enlarged lymphatic glands can be felt. The patient states that it is with the greatest difficulty that he can have an evacuation from his bowels; enemas are necessary and he finds he can receive and retain very little water without it causing great pain. He passes some mucus with his stools, but no blood nor pus. He has increasing difficulty in passing his urine. There is a large left inguinal hernia which is not completely reducible. Examination by rectum reveals nothing except that the rectum is empty and that it is ballooned.

The operation was done the day after his admission to the hospital. Ether anæsthesia was used; a left longitudinal incision along the outer border of the left rectus abdominis muscle was selected. As was supposed, the tumor involved the sigmoid flexure. It was found to be an enlargement which felt solid and which seemed to involve the whole periphery of the colon equably; it was about 14 cm. long and about 6 cm. thick (diameter). It was adherent to the fundus of the bladder, and the coil of intestines which escaped through the left inguinal canal was also adherent to it, and the mesentery of this intestine was very extensively and firmly united to it. After great difficulty and with a very tedious dissection the adhesions were finally severed and the tumor freed. It was then removed and the

severed ends of the colon united by an end-to-end anastomosis. The sac of the inguinal hernia was also dissected out and a modified Bassini operation was done. The operation was a tedious and a long one, but the patient stood it very well. The day after the operation the patient's abdomen was somewhat distended, but he passed considerable flatus during the day. The second night he began to vomit and notwithstanding several washings out of the stomach he continued to vomit. Distention of the abdomen was so considerable that I ventured to pass a rubber tube and wash out the colon above the anastomosis. This did not, and nothing else that I could do, relieve the complete paralysis and stasis of the bowels; on the fourth day after operation his heart showed such unmistakable signs of weakening that I determined to open his intestine. Accordingly, under Schleich's local anæsthetic I made an incision in the left abdomen and drew out a knuckle of the colon just below the splenic flexure, fixed it to the skin and opened it. This little operation was, however, too much for the patient; he fell into a coma from which he did not recover for several hours. He died the fifth night after his operation. Myocardial weakness was exhibited in the usual classic symptoms the last day of his life.

I believe if I had done, as I intended to do, an ileocolostomy after removing the tumor, the patient might have lived. When I mentioned this possibility to him before the operation he begged so urgently that I should not do this that I was moved against my better judgment to make an immediate anastomosis. After such long and almost complete damming up of the whole intestinal tract, immediate and complete drainage would certainly have been best. The pathologist's report will give a complete description of the tumor, but I would like to emphasize the fact that when examined immediately after the operation the tumor mass presented the gross appearance of the colon, which had been almost entirely occluded by enormous thickening of its muscular walls; the lumen had been reduced to a canal that would scarcely admit my little finger (about 0.5.cm.). *There was absolutely no ulceration*

FIG. 1.—Myofibroma of sigmoid.

of the mucous membrane, and this layer appeared quite normal. No cicatrix nor bands of fibrous tissue were found macroscopically in any of the coats. Only one large lymphatic gland was found in the mesocolon opposite the tumor.

The especially interesting and important point is that the tumor was formed *in the walls* of the intestines, and that the stricture of the sigmoid was produced by, and exactly at the site, and for nearly the whole extent of the growth or thickening of the muscular tunic of the intestine. *The stricture was not below the growth, but within and produced by the growth.*

Report of the Pathologist, Dr. A. L. Kotz.—The specimen (Fig. I) was a spindle-shaped tumor involving the entire circumference of the intestine, 14 cm. in length and 5.5 cm. in its thickest diameter. The lumen of the intestine at its most constricted portion was less than 0.5 cm. in diameter. On section it was found to be a hyperplasia of the various layers of the intestinal wall, with numerous small granular foci in the outer tunic.

The mucosa was intact throughout the entire extent, but very much puckered, and with the submucosa, which was also in excess, formed a thickness of 0.7 cm. This surplus of membrane evidently resulted from contraction of the longitudinal muscular and serous layers, as like conditions were also found in the circular muscular layer and in the mesosigmoid.

The muscularis formed the greater bulk of the tumor. The circular layer was 1 cm. in thickness. The bundles of fibres were broad, flat and compact; this also was due to a crowding of this layer from shortening of the intestine.

The longitudinal layer, about 0.5 cm. in thickness, was very compact and closely united with the circular layer. Its outer surface was in some places more or less blended with the fibrous tunic of the serosa, and in others separated from it by granular foci. These deposits also penetrated into the muscular substance.

The serous tunic including the subserous connective tissue formed a dense, uneven, pigmented layer of variable thickness, and contained numerous granular foci. It formed a tense covering of the tumor, as was apparent from the extreme aversion of the intestine in the longitudinal section. This, too, explains the crowding of the other layers and mesosigmoid. That the active etiological factor was here located is evident, as will also be seen by the histological findings.

The mesosigmoid contained a large amount of connective tissue with most of its fibres running visceroparietally. From its appearance this was more of an accumulation than actual hyperplasia, and evidently resulted from contraction of the intestine. The mesenteric glands found were few in number and slightly enlarged.

The histological changes, like the gross findings, were mostly confined to the fibrous tunic of the serosa and external muscular layer. This was found the seat of a chronic tubercular inflammation extending over the entire tumor, as was evidenced by microscopic findings, as follows: A high degree of capillary engorgement, small cell infiltration, hyperplasia and pigmentation; granular foci, consisting of lymphoid, epitheloid and giant cells; in the latter tubercle bacilli were demonstrated; and areas of cicatricial tissue due to the healing of old tubercles. The connective tissue throughout the entire tumor was hyperplastic, more marked in the outer than inner layers. The muscular tissue predominated, it was pale, the nuclei elongated and stained poorly. The epithelium was well preserved. The solitary and mesenteric glands both were slightly infiltrated.

Summarizing from the gross and microscopic finding, we have a tumor of the intestine in which the predominating elements are muscular and fibrous tissue respectively; a tumor resulting from an inflammatory hyperplasia, with contraction of the longitudinal muscular and serous layers and thereby causing circumstantial hypertrophy by crowding of muscular elements; a chronic tubercular process in the external layers of the intestine as the etiological factor.

In accordance with the predominating component elements of the tumor, I believe we are justified in considering it a myofibroma.

The etiology of the patient's condition, and the pathologic explanation of the development of a myofibroma of the sigmoid, are to me exceedingly interesting, and difficult to meet. The nature of the first tumor, which appeared about seven years before the patient entered the hospital, and which completely disappeared after the abscess, which developed, had been evacuated, drained and finally healed, is very doubtful. It certainly felt like a solid and quite hard tumor, it was to the outer side of the upper rectum and seemed fixed to the side of the pelvis, it could be felt by a finger passed into the rectum and was below the site of the second tumor. The tumor *entirely disappeared* after profuse suppuration and marked septicæmia of the patient.

Several explanations occur to me. The first one is that it might have been a left-sided appendiceal abscess; the findings at the second operation would hardly bear this out, however. A second suggestion is that the tumor really was a new growth from the side of the bony pelvis,

which by pressure produced a closure of the lumen of the rectum high up; infiltration of the cellular tissue about the rectum resulted, infection from the rectum or colon followed, suppuration and the abscess came as the natural sequence. Relief of the abscess with subsequent resolution affected the tumor as well as the other tissues in the immediate neighborhood, and gradual absorption may have occurred in the tumor. Mixed toxins must have been present in abundance, a sort of Coley's fluid may have been developed, and a cure of the original tumor resulted. This view would afford a partial explanation of some of the extraordinary hypertrophy of the muscular layers, which finally grew to such remarkable thickness that a tumor was formed and the intestine was again occluded. The persistent effort of the colon to relieve itself of the burden of accumulated fæces would naturally result in a thickening of the muscles, and if long continued very marked hypertrophy might occur. The entire absence of any papillomatous or other growth anywhere in the colon or rectum, and the fact that the mucous membrane of the intestine was quite healthy, indicate that the inflammation did not primarily come from any disease of the lining of the intestine. I searched in vain for extensive matting or adhesions in the pelvis or about the bladder, to prove that the abscess which formed nearly seven years before was the result of an appendicitis or other intestinal rupture. True the bladder *was* adherent for a considerable area, but there were no strong fibrous adhesions to the walls of the pelvis and to the lower coils of the small intestines and to the omentum, as there naturally would have been if the old abscess had been an appendiceal one. The adhesions were confined to the area between the sigmoid, the pelvic walls, the bladder, and the coil of intestine and its mesentery, which passed obliquely across the anterior surface of the tumor.

Dr. Kotz says positively there were tubercular bacilli found in the necrotic spaces in the muscles. This finding

may furnish the key to the whole matter. If the former tumor had been a tubercular infection of the mesosigmoidal lymph-nodes, which finally suppurated and were discharged, it is conceivable that an invasion of the coat most affected in trying to overcome the obstruction of the bowels should follow secondarily, and remain the nidus of a persistent chronic inflammation, and hypertrophy of the muscular tissues would continue as a result of increased work resulting from the torsion or deviation, or possibly the adhesions of the sigmoid, already mentioned. That this hypertrophy should be of such extraordinary thickness that it finally formed a *tumor* large enough itself to produce obstruction is certainly remarkable and as far as I know it is unique.

Prof. J. Rotter in Arch. f. klinisch. Chirurg., Vol. 61, p. 866, discusses non-malignant strictures of the sigmoid. He calls especial attention to the fact that the upper part of the rectum and the sigmoid are very rarely strictured by inflammations. It is very rare indeed for a tubercular stricture to affect the sigmoid or colon, and when this *does* occur the origin of the disease is in the mucous membrane. All of the diseases which produce non-malignant strictures, —namely, gonorrhœa, syphilis, tuberculosis and dysentery,—have the common starting place, viz., mucous membrane.

Rotter says there is scarcely anything in surgical or anatomical literature concerning cases of stricture of the sigmoid resulting from inflammations which do not originate in the mucous membrane, and such cases are exceedingly rare. He credits Graser with the honor of having published the first case of this kind in Munchener Med. Wochenschrift, 1899, No. 22, and in Langenbech's Arch. fur klin. Chirurgie, Bd. 59, 3. Rotter in this article publishes three cases of his own, all of them suppurative cases, and they produced strictures by bendings of the lumen of the sigmoid from adhesions and fibrous contractions. In one of his cases there was a one-sided thickening of the intestinal wall *above the stricture*, the stricture itself having

been produced by a flexion of the sigmoid and fibrous narrowing. In al these cases the mucous membrane did show signs of involvement, but Rotter argues that this involvement was only secondary through suppuration and sinuses.

Graser's explanation of these strictures based upon some very interesting experiments, quoted by Rotter in this article, is as follows: The blood supply to the sigmoid is carried by devious channels from the mesentery to the mucous membrane. They are so arranged that they serve as blood-storers,—small reservoirs of blood,—which communicate with small spaces (Lucker) in the mucous membrane. In certain conditions of blood pressure, notably in condition of chronic heart disease, which lessen the force of the blood, these spaces become partially empty and into these gravitate material from the lumen of the intestine. These spaces gradually elongate and enlarge from pressure until diverticula form; infection extends to the mesentery and there an abscess develops; the pressure of this abscess in the mesentery will cause obstruction more or less, according to the size of the abscess. If the abscess be safely evacuated by sinuses into the lumen of the gut, or by incision externally, the contraction of the fibrous tissue which results will cause a thickening in the mesentery and a deviation or bending of the sigmoid, its lumen may be markedly narrowed and finally a stricture will result.

Graser's theory fits the history and the apparent condition of my case in some respects very closely. Graser, Rotter, nor any other writer of whom I know anything has ever reported a case of a genuine inflammatory, or hyperplastic, myofibroma which involved the whole circumference of the sigmoid, and which on account of its bulk produced almost complete and symmetrical obstruction of the gut. This case seems, as I said before, unique. It was a genuine and symmetrical tumor, and while of inflammatory origin was histologically a myofibroma.

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THE OPERATIVE TREATMENT OF CANCER OF THE LARGE INTESTINE, CAUSING DANGEROUS INTESTINAL OBSTRUCTION.*

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WHEN one reviews the conditions of the large intestine requiring surgical treatment, the subject of intestinal obstruction is at once presented for consideration. These cases are frequently in elderly patients due to occlusion of the lumen of the intestine by carcinomatous growths. The lesion is situated in the intestinal wall and presents in its earlier stages almost no characteristics which can be detected by physical examination. It is usually found in the descending colon and is adenocarcinomatous in character. The symptoms may be indefinite for a long time, and not until the occlusion is marked does the spasmodic pain, vomiting, distention, etc., present the clinical picture resulting from marked interference with fecal circulation. These cases, since they are usually not seen by the surgeon till he is called to relieve the obstruction, present the following complications:

1. The difficulty in determining the cause of the patient's condition.

2. The difficulty of determining its location.

3. The danger to the patient of shock from the prolonged difficult exploration often necessary to ascertain accurately the above-mentioned facts, and from the operative procedure required to radically relieve him.

For purposes of illustration I report the following

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* Read before the American Surgical Association, May 30, 1906.

clinical history of a case in which the colon was resected to relieve dangerous intestinal obstruction due to cancer.

The patient was a single man, forty-eight years of age, of Scotch parentage, and a laborer by occupation, who was admitted to my service at the Boston City Hospital on February 15, 1904. He gave the following history: That he had been well till fifteen years ago. He then suffered an attack similar to the present one, but less severe in character. For the last ten to twelve years there has been habitual constipation, necessitating the more or less constant use of cathartics. In 1894 a right scrotal hydrocele was noticed, which has been tapped each year since. It is now of large size. In 1902 he had an attack of pleurisy, after recovering from which he was apparently well till February 10, 1904, on which date the attack began which forced him to seek relief. This attack was characterized by abdominal pain which at intervals became quite severely acute or "cramp-like," and was referred to the subumbilical region. For three days (February 7–10) previous to this attack there had been no dejection. On February 11th enemata were followed by a dejection. From February 11th to the 15th the bowels moved once daily, the dejections being small in amount, and consisting of hard, fecal masses, but no mucus or blood. There was slight nausea, and vomiting after food even in small amounts. The pain after the first of the attack almost disappeared. There was anorexia and loss of strength. On February 15th he entered the hospital.

When examined he seemed to be in a fairly good general condition. His expression was somewhat anxious. Tongue was covered with a white, creamy coat. Glands not especially enlarged. Heart and lungs negative. There was a very large scrotal hydrocele. Temperature was 100.5; pulse 80. In the right side of the abdomen over the kidney-shaped area shown in Figure 1, there was fullness and a marked tympanitic resonance. Abdomen elsewhere was only moderately distended.

During the 16th, 17th and 18th of February, under treatment, the subjective symptoms were relieved. Temperature 98 to 99.5°. Pulse, 80, 72, 85, 100. The patient was quite comfortable. He occasionally vomited after taking liquid food. High enemata (twice a day) produced slight results. The swell-

ing and tympanitis increased slowly, as shown in Fig. II. On February 19th vomiting began to occur every few hours, becoming fecal in odor and character. The abdomen rapidly distended and became tympanitic. The condition of the right side changed as shown in Fig. III. Temperature 99.5°, pulse 100–102. This rapid change for the worse required radical treatment, but the

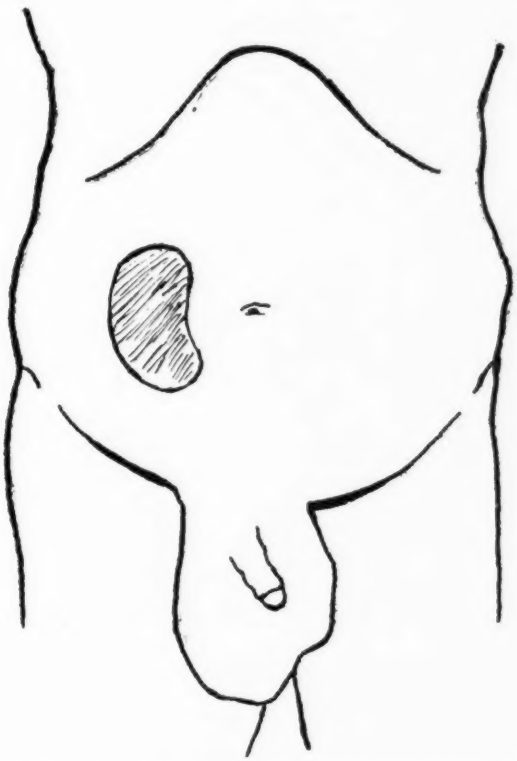

FIG. 1.—Shaded kidney-shaped area shows site of special intra-abdominal fulness and tympanitic resonance.

consent of the patient for operation was not obtained till 6 P.M. on the 20th. An attempt was then made to find the obstruction and relieve it. The patient's general condition was at that time rather poor. There were signs of exhaustion. Temperature 99.6°; pulse 100–105. Face anxious. Symptoms of the 19th still existed. The abdomen was well distended. On the right the conditions shown in Fig. III were present. The apparent

tumor seemed fully four inches in diameter and extended from the costal border to the iliac region.

Under ether an incision in the median line extending from the navel towards the pubes opened the abdomen. The tensely distended loops of intestine at once protruded, rendering exploration of the abdomen exceedingly difficult. An attempt was made to overcome this difficulty by incising one or two loops

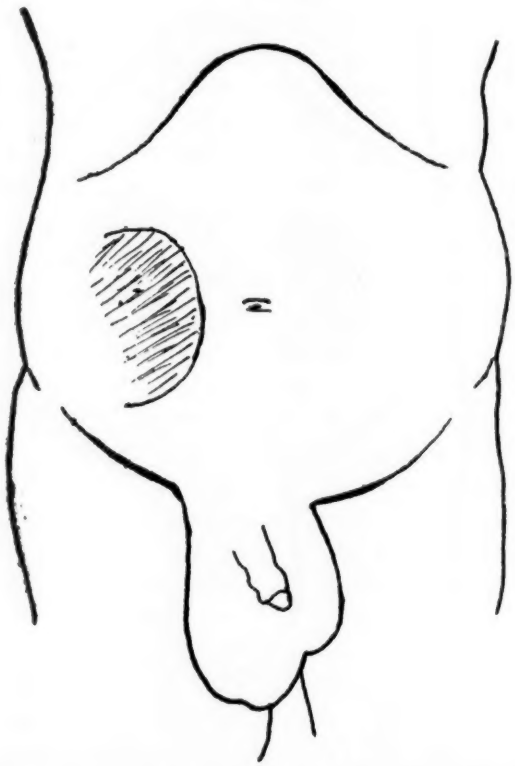

FIG. 2.—Increasing swelling and tympanites, three days subsequent to condition shown in Fig. 1.

along the free border in hope that after their contents had been evacuated the intestine would collapse enough to give room for the hand in the abdomen. But although about 500 cc. of liquid fæces were thus removed, the remaining coils of gut were little, if any, affected and still rendered any exploration of the abdomen exceedingly difficult. This failure to empty the intestine

promptly under the above conditions has since been quite satisfactorily explained by the careful study of intestinal anatomy by Dr. George H. Monks (ANNALS OF SURGERY, vol. xxxvii, p. 543, October, 1905).[1]

After waiting in vain for the intestine to be emptied the incisions in the gut were sutured and the abdomen explored as

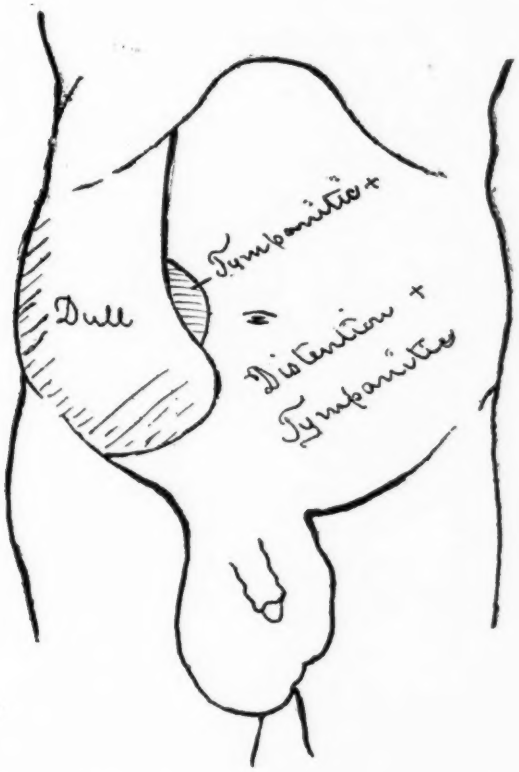

FIG. 3.—Condition on fourth day subsequent to date of Fig. 1.

well as possible, in spite of the interference from the distended coils of intestine which still filled it. No band, twist, tumor, intussusception, or other obstruction could be found. The condition of the abdomen previous to operation, shown by Fig.

[1] The Mütter Lecture on the Surgical Anatomy of the Small Intestine and Mesentery, delivered at the College of Physicians of Philadelphia, by Dr. George H. Monks on December 2, 1904.

III, was found due to an enormously distended cæcum and ascending colon, for which no cause was discovered.

On account of the patient's general condition becoming alarming, which left no time for further exploration for the cause of the obstruction, the search was abandoned and all efforts directed to the end that the patient might leave the operating-room alive. To accomplish this the cæcum was rapidly exposed through an oblique incision of the superjacent abdominal wall. It was then sutured in the wound so as to close off the peritoneal cavity, and opened by a one-inch incision. Two or three litres of liquid, pea-soup-like fæces were evacuated.

A rubber tube was now fastened into the colon wound by two superimposed purse-string sutures, and the wound after being loosely packed with iodoform gauze was partly closed with two silkworm-gut sutures. The median incision was closed with "through-and-through" silkworm-gut sutures. The patient was then put to bed with syphon drainage of the colostomy wound.

There was marked shock, but the patient recovered from the ether and slowly reacted under treatment. On February 21st, the day following the operation, the temperature was 101.2°, and the pulse 128–129. The intestine gradually emptied itself through the tube in the colon into a bottle hung at the bedside, and the obstructed intestine was temporarily relieved. The vomiting ceased at once after the operation. The abdominal pain also disappeared promptly.

On February 24th the temperature had gradually dropped to 99.5° and the pulse to 98–105. The colostomy tube was removed and the lower bowel was cleaned by a high enema. On the night of the 24th, without any apparent reason, the patient twice got out of bed. During the succeeding days the patient continued to improve and gradually became stronger. The median incision was healed on March 7th. The colon wound closed in so that on March 20th it barely admitted the little finger. In the early part of April the patient's general condition had markedly improved. He was up and about daily. There was still a fecal discharge from the colon opening. It was then found that unless the intestine was emptied by laxatives and enemata every second day, symptoms of obstruction would begin to appear. It, therefore, seemed indicated that another

attempt should be made to locate and remove the persisting obstruction. The data obtained from observation of the case seemed to indicate that it was probably a neoplasm situated in the wall of the intestine and filling its lumen. On account of the distention of the colon at the time of the first operation being limited to the ascending portion, the hepatic flexure was probably its location. Therefore, on April 13th, after careful feeding and preparation, a second operation was performed.

Under ether the abdomen was opened in the median line above the navel by an incision (which before the exploration was completed was enlarged so that it extended from just below the sternum to the umbilicus) and explored.

Bands of adhesions between the intestine and the abdominal wall appeared. The separation of one of these caused an injury to the gut-wall which was closed by a continuous silk suture. The intestine was empty. Contrary to expectation, careful examination of the transverse colon and vicinity failed to discover anything abnormal. There was no obstruction at that point. Finally, after exploring the whole abdomen carefully without result, suddenly a small, hard, movable mass was by chance felt in the left iliac region. This was apparently a small indurated section of the gut, probably a tumor, involving the intestinal wall.

An oblique incision four inches long was now made in the left lower quadrant of the abdomen over the growth, and through this wound the mass was exposed. It proved to be a tight, annular stricture of the intestine at the junction of the descending colon with the sigmoid flexure. It involved the entire circumference of the intestine, forming a band about 2 cm. wide, which showed a well marked constriction. The growth was apparently well localized. With considerable difficulty it was "walled off" with aseptic gauze, isolated by rubber bands passed through the mesentery and clamped, and about two inches of colon with its adjacent mesentery resected. No affected lymph-nodes were found. The intestine was then closed by an "end-to-end" union. This was made with a "right-angle" continuous fine-silk suture, reinforced at two points by a single Lembert stitch. A very thick, fat mesocolon and the slight mobility of the growth interfered much with the application of the suture. The abdominal wound was then closed by nine deep catgut and an

interrupted superficial silkworm-gut suture. The median wound was united by "through-and-through" silkworm-gut sutures. No drainage. Dry aseptic gauze dressing.

The operation lasted one and one-half hours, but was followed by very little shock. The recovery from ether was good, and after the first twenty-four hours the patient did well. During the next few days he was quite comfortable. There was practically no fecal discharge from the colostomy wound after the operation.

The recovery from the operation was uneventful. On the fourth day the temperature and pulse reached normal and remained so. The highest temperature, 101.8°, was on the night following the operation. The highest pulse-rate, 120, was recorded twenty-four hours later. The patient's general condition steadily improved and his strength increased. After the operation no cathartics or enemata were used till April 29th. There was a spontaneous normal dejection on the seventh day. The operation wounds healed by primary union. Patient got up on the twenty-third day. The artificial anus closed spontaneously on the eleventh day after the colon was resected and the obstruction removed. On May 5th the colostomy wound was completely healed.

The patient rapidly gained in strength and weight, and was discharged apparently well on May 9, 1904.

Examination of the resected intestine showed the excised tumor to be situated in the intestinal wall, and by its growth to have so occluded the lumen of the intestine as to leave an opening only 2–3 mm. in diameter. The microscopic examination made under the direction of Dr. F. B. Mallory, at the Pathological Department of the Boston City Hospital, showed the tumor to be an adenocarcinoma, and that it apparently had been resected well beyond the limits of the growth.

The patient has continued under observation till the present time, a period of two years since the removal of the cancer. He has had very little discomfort during this period and is apparently well. It was four or five months before he fully regained his strength. On May 3, 1906, I could detect no signs of recurrence. He states that there has been at times some discomfort at the site of the colostomy wound. This gradually became much less frequent than at first, and at present is scarcely

noticed. He says that he "can feel everything that he eats passing through there." The intestine acts normally, one daily dejection without the aid of medicine. He has recently increased in weight thirty pounds. Examination of the abdomen is negative. The scars are firm and do not bulge on coughing. (Fig. 4.) There is no tenderness.

The prognosis in this case is good, since the possibility of removal and freedom from recurrence—if not permanent, at least for a term of years—in cases of this form of adenocarcinoma of the colon, has been demonstrated, especially where the growth has not spread outside the intestine. There are results of this character on record, and such has been the result of those cases which have come under the personal observation of the writer.

The above record is a fair example of one type of colon obstruction, and when considered in detail presents certain features which seem worthy of attention, viz.:

1. It is important to recognize the character of the obstruction, whether it is transitory or permanent. Accumulated fæces resulting from chronic constipation due to functional causes can present a clinical picture similar to organic obstruction in the earlier stages. Chronic obstruction is more apt to be obscure. The symptoms and clinical picture are not so characteristic as in the acute cases, such as strangulation, volvulus, intussusception, etc. In cancer, as a rule, the occlusion is so gradual that a diagnosis is usually made only after the obstruction has so occluded the intestine as to produce marked symptoms—pain, nausea, vomiting, distention, complete constipation. In elderly people a history of persistent constipation requiring the more or less constant use of drugs should always attract attention and the possibility of cancer of the colon be considered.

2. Equally important is a recognition of the site of the obstruction. This is often difficult since the abdomen is a region where the anatomy and pathological physiology of its contents are varied and complex. Data obtained by exter-

nal examination cannot always be accurately interpreted. For instance, it is usually accepted that an obstructed gut is distended above and collapsed below the point of obstruction. In the case just reported both external and internal examination showed the colon with marked distention as far as the hepatic flexure, while beyond that point it was of normal size, if not smaller. Yet notwithstanding this the lesion causing the obstruction was low in the descending colon. For this condition no wholly satisfactory reason has been suggested.

Again, this lesion may be so small, affecting only the intestinal wall, as to be readily overlooked by the surgeon during exploration, especially when the abdomen is filled with distended coils of intestine. It must be actually seen or felt to be recognized. Many instances have been recorded where a condition apparently probable from clinical data at hand has been found by exploration not to exist in fact. Hence the difficulty of locating such an obstruction.

3. Another problem presented to the surgeon is the expediency of finishing the operation in one or two sittings. In suitable cases there is no question but that a single operation is to be preferred. When the patient's general condition is good, and the wall of the intestine normal or nearly so, a growth can be excised at once, but in many of the cases certain conditions obtain which are unfavorable for immediate resection.

First. The ability of the patient to endure the severe shock resulting from the prolonged manipulation. A patient is often already in a critical condition from the effects of his illness. If he can be temporarily relieved by some expedient, as an enterostomy or colostomy, the operative exposure is diminished and a life saved which otherwise would be lost.

Second. The conditions for exploration and resection are much more favorable for efficient thorough work at the second operation. It is performed in an abdomen containing only an empty intestine in place of an extremely dis-

FIG. 4.—Showing scars left after repeated abdominal sections for relief of intestinal obstruction.

tended one. It is performed more easily, since the operation is not impeded, and consequently is finished much more rapidly. All of which, of course, shortens the exposure and diminishes the shock. By the temporary relief obtained from the first operation there is an opportunity for the patient to recover and he will therefore be in a much better general condition to endure the second. In the case reported, if the attempt to find the obstruction and resect the colon had been persisted in at the first operation the patient would probably have died at once.

Third. The chances of successful union are much greater when a normal empty intestine is sutured than when a semi-paralyzed one full of stagnant fæces, toxins or ptomaines, is the site of operation. At the primary operation the intestine is apt to be dilated, its muscle exhausted, its wall thickened and œdematous, the contents especially septic; in short, the whole situation is most unfavorable for successful wound union. In a recent article on this subject Dr. J. W. Elliot[1] states that the mortality from the usual operation of enterectomy with immediate suture is 50 per cent. at least in the hands of the best surgeons, and in some hospitals as high as 85 per cent. The principal cause of death is septic peritonitis, due sometimes to infection by intestinal contents at the operation, but more often to the fact that the most perfectly placed sutures or mechanical devices do not hold. He attributes the giving way of the suture to the diseased condition of the bowel at the time of operation. He recommends enterostomy or colostomy, with later enterectomy, in patients unable to bear primary enterectomy, and regards this as the operation of choice in all critical cases of intestinal obstruction. The method of operation in two sittings is not new. It has been practised and published by many surgeons of note, but notwithstanding this its value is still often lost sight of in the surgeon's

[1] ANNALS OF SURGERY of 1905, Vol. xlii. p. 668. "The Management of Certain Critical Cases of Intestinal Obstruction, with Report of Cases."

zeal to complete his work at one sitting. But in these cases temporary relief is of far more immediate importance than the removal of the disease. I therefore wish to emphasize the importance of this method.

Fourth. Another fact to be considered is the futility of an attempt to rapidly empty a distended, half-paralyzed intestine by incising separate coils. Such incisions have only an immediate local effect. To accomplish the desired object the drainage must be continued for several hours. The surgeon cannot wait so long for the necessary result. The slow emptying of the incised gut, as Dr. Monks has explained, is caused not only by the sharp curves and kinks which the mesentery causes in a distended intestine, but also to external pressure and especially to the gas and semi-liquid contents which act like plumbers' traps. The fluid portions are in the dependent loops and obstruct the passage of gas. The gas is in the upper part of the coil and cannot pass the liquid. Neither gas nor liquid can pass on without the peristaltic wave, which is absent in a paralyzed gut. But when an artificial anus is made and continual drainage through a tube is established, the intestine after a time is able to empty itself and gradually recovers. Both the above facts were demonstrated in the case of the patient under discussion,—*i.e.*, the futility of immediate and the success of continued drainage.

Fifth. The question arises also in these cases, where first a palliative and after relief a second radical operation is performed, as to the comparative value of internal procedures, such as lateral anastomosis for the purpose of "side-tracking" the obstruction, or of the method of external drainage, as by a colostomy. Some operators prefer the internal method; others select the internal for the less severe cases and the external for the extreme ones; while another set prefer the external in nearly all cases. There can be no question that in some cases where the intestine is in good condition this internal method can be safely performed and possesses advantages which readily suggest

themselves. But in the severe cases where the gut is in an abnormal condition the "external" drainage has more advantages. One has positive knowledge that the drainage is efficient. If necessary it can be assisted. It has also occurred that a section of paralyzed gut from absence of peristalsis has caused as effective an obstruction as a strangulation, and unless the anastomosis in such a case is beyond the paralyzed area the patient would not be relieved. Again, operations done on intestines under these conditions and with contents of such a character are often followed with marked local reaction. I have seen the resulting œdema at the point of suture so great as to occlude an opening having the same lumen as the gut. By the external method such changes can be at once noted and treated. One always has a much more accurate knowledge and control where local conditions are open to inspection and manipulation. Therefore, it would seem wise to employ the "external" method unless the surgeon can feel sure that the condition of the intestine is normal or nearly so at the point of suture. There is no objection to the temporary fecal fistula from fear that it cannot be closed. The tendency is to spontaneous closure after the obstruction is relieved. In this case it closed spontaneously on the eleventh day. If this does not occur it can usually be closed by operation. The objection has been made that the presence of an open fecal fistula greatly increases the danger of infection at the second opening of the abdomen. It is true that this danger exists, but by proper preparation and technique it can be avoided. In the case reported an extended exploration of the abdomen was made through a median incision and the colon was resected through an iliac incision notwithstanding a fecal fistula had been emptying the cæcum on the right side up to the day of the operation.

It is also claimed that the delay resulting from postponing the radical operation offers an opportunity for increased growth and extension of the neoplasm, and for the production of pathological changes in the adjacent tissues

unfavorable for operation. On the other hand, however, in those cases where the tumor is found it can generally be isolated and sutured outside the abdomen by one of the several methods already in use. Then at the second operation the growth can be excised and the colostomy opening closed. When the obstruction cannot be found the operator has, of course, no choice. He must drain externally. He has nothing to resect.

Sixth. In conclusion I would call attention to the method of multiple incisions for an extended exploration of the abdomen in place of a single long incision. By this method important structures, such as nerves, vessels, and muscles, remain uninjured and the patient escapes the disagreeable after-effects of such injuries. Also an incision directly over the area in question gives direct access to the site of operation in place of the indirect approach obtained only by powerful retraction of the edges of an incision placed at a distance. No single incision can be placed in the abdomen which will possess the above-mentioned possibilities without much increased risk to the patient and injury to important structures of the abdominal wall. The accompanying photograph (Fig. 4) shows the results of this method.[1] The two wounds in the median line overlap so that the resulting scar is only two inches shorter than the distance from the xyphoid tip to the pubes. There is a four-inch oblique scar in the left iliac region and a rather broad, depressed, three-inch oblique cicatrix in the right iliac area at the former site of the temporary artificial anus. All are firmly healed and show no tendency to hernia. The tonicity of the muscles is apparently normal.

[1] This photograph was taken on May 12, 1904. The resection wound now appears almost as a line scar, with no suture marks. The photograph shows a reversed or "mirror" picture, the right colostomy scar appearing on the left, and the left resection wound appearing on right

INDIVIDUAL EXCISION AND SUTURE IN OPERATING FOR THE REMOVAL OF HEMORRHOIDS.[1]

BY LEWIS STEPHEN PILCHER,

OF BROOKLYN, NEW YORK,

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THE method which forms the subject of the present communication, in its details, has been elaborated in my work at the Seney Hospital, in Brooklyn, during the past few years. It has given much satisfaction, and from its simplicity and the freedom from unpleasant complications in the after-course of the cases thus treated, and the certainty and security of the healing which has followed, seems to be almost ideal in its character. Doubtless similar methods have been used by other surgeons, but I do not know of any full and systematic description of the procedure as a whole either in periodical or text-book literature.

It is true that the old methods of removing hemorrhoidal masses by ligation, or by the clamp and cautery method, have been quite efficient in securing the cure of the disease in all ordinary cases of hemorrhoids; nevertheless, to the critical surgical mind it has always been a fair objection to these methods that they lack that finish, that completeness of fine surgical technique, which in these days of more perfected surgical methods ought to be given to such cases as well as to others. The complete excision of the so-called pile-bearing segment of the rectum, in cases of very aggravated hemorrhoidal degeneration, the method of Whitehead, is complete as a surgical procedure. The diseased structure is removed in toto; the parts from which the disease is excised are brought together in good apposition; and a primary union is accomplished. In certain cases it is a method which ought to be resorted to, and must be if perfect

[1] Read before the American Surgical Association, May 30, 1906.

relief is to be secured; such as in cases where the lower segment of the rectum is practically converted into a continuous, circular, cavernous tumor, mixed with inflammatory products, in which there are no longer present the discrete masses which are found in most cases that call for attention. It is, however, of the general cases of moderately severe hemorrhoids (Fig. 1), such as most frequently apply for surgical relief, for which the method of Whitehead is unnecessarily severe and extensive, that the method which I now describe is applicable; cases to which the old methods of ligation or of the clamp and cautery were peculiarly applicable and were most frequently resorted to.

Whatever the method of operating, the antecedent preparations are the same,—viz., the emptying of the bowel 24 or 36 hours previously by a cathartic, and the washing out of the lower bowel by a copious enema not later than eight hours before the operation, so that the rectum is thoroughly empty when the parts are subjected to surgical interference. Complete surgical anæsthesia, the exaggerated lithotomy position, thorough dilatation of the sphincter,—all these are to be used in any procedure, and are to be resorted to in the cases now to be described.

The sphincter having been divulsed (Fig. 2), the lower segment of the rectum rolls out and is readily and fully exposed to view, so that a full estimation of the nature and extent of the disease is presented.

The next step is also common to all methods, determining how many of the hemorrhoidal masses, and what ones, should be removed. This is best effected by seizing the projecting masses with as many pairs of ring-forceps (Fig. 3) as may be required, according to the judgment of the surgeon. Up to this point nothing peculiar in the method has developed; but from this point my own method begins to present its special features.

One of the masses grasped by the ring-forceps (as a rule one located at the posterior commissure of the anus is first to be chosen) is pulled out so as to put the parts at its

FIG. 1.—Protruding hemorrhoids of moderate size. (Sketch made in operating room immediately previous to operation for removal.)

FIG. 2.—The dilatation of the sphincter ani.

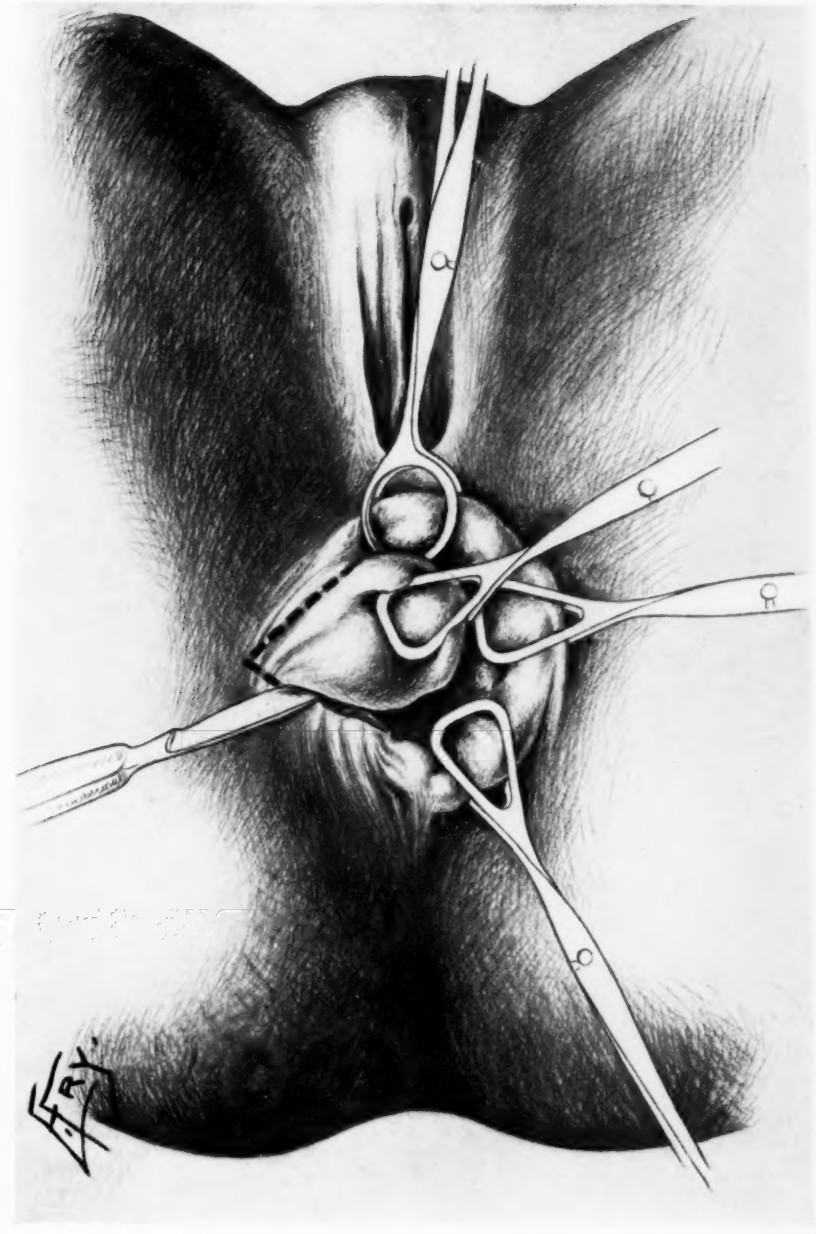

FIG. 3.—The most discrete hemorrhoidal masses seized by ring forceps; one is being loosened from its base externally by the knife.

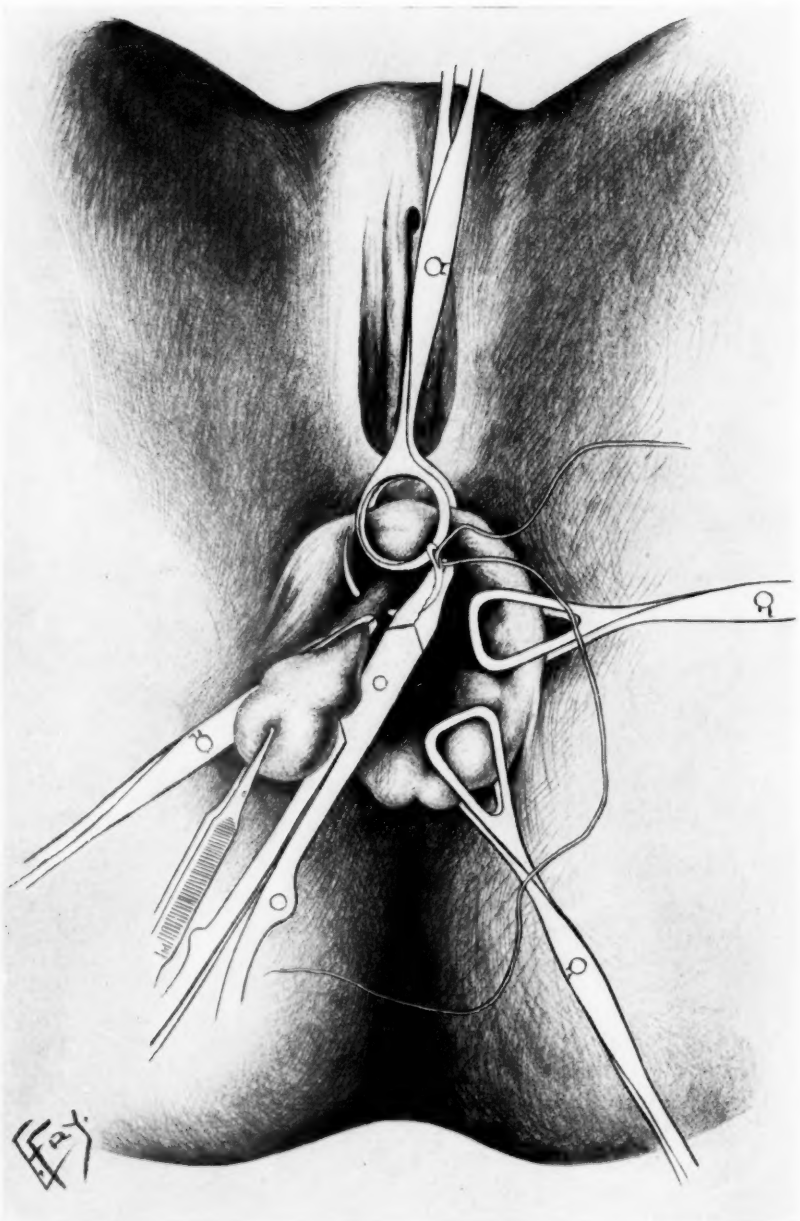

FIG. 4.—The loosened hemorrhoid attached by pedicle of mucosa, which is clamped by hæmostatic forceps; a ligature is being passed through the fold of the mucosa above the point grasped by the clamp.

base well upon the stretch. Since the lower edge of the ring applied to the pile involves the muco-cutaneous junction, as the base of the pile is put upon the stretch, there is produced a cone whose apex passes upward to the normal mucous membrane, and its base passes outward upon the normal skin surrounding the anus. Then a longitudinal incision through the mucous membrane and skin on either side of this cone at the muco-cutaneous junction is made (Fig. 4), which passes out onto the skin of the neighboring perianal region so as to include as long and as extensive a triangle of skin as may be required to obtain a desired retrenchment of the redundant perianal skin, when the final suturing of these incisions shall have been done.

Owing to the vertical direction through which the blood-vessels of the lower rectum descend in the submucosa to the margin of the anus, it is possible to make these vertical incisions described on either side of the telangiectatic mass grasped in the forceps, without producing much hemorrhage.

Then, beginning with the apex of the little triangular flap of skin that has been marked out, this is dissected up from the fibres of the sphincter to the base of the pile mass above; as the result of this, the mucous membrane on either side of the pile having been divided from the tissue on either side by the preliminary longitudinal incisions, and the skin-flap to be removed having been raised up, the continued traction of the ring-forceps raises and isolates to a suitable extent the whole pile mass. Now, if into the sulcus thus produced an ordinary pair of Kocher's hemostatic forceps is thrust up so as to grasp the comparatively narrow pedicle of the pile (Fig. 5), it will not only enclose the whole of it but will reach up to the normal mucous membrane above, so that its vascular supply is wholly controlled. Practically, the situation is the same as when the surgeon applies the clamp for the cautery operation. The portion of the pile that protrudes beyond the clamp is now cut off flush with the clamp by knife or scissors, just the same as in the cautery operation. The special point of the method now presents itself.

Remembering that the chief blood-supply of this pile descends into the submucous tissue vertically from above, if underneath the fold of mucous membrane which is just above the po nt reached by the clamp (Fig. 6) a curved needle, armed with ligature threads, is passed well into the submucous tissue, and, being drawn through, carries such a thread, when it is tied the main blood-supply of the parts below is cut off.

This is the key to the situation,—*the passing of this needle through the fold of mucous membrane just above the point reached by the clamp, and the application of the ligature at this point, tied tightly.*

For this ligature chromicized catgut is to be preferred, and it should be long enough to serve not only for this primary point of ligature, but also for the subsequent suturing now to be described.

The needle, still armed with the long end of the ligature thread, is now carried as a running suture around the mass in the grasp of the clamp, passing through the mucous membrane and the tissues underneath the arms of the clamp two, three or four times, as the extent of the disease may seem to require, until all of the tissues grasped by the clamp have been included. (Fig. 7.) The clamp is now loosened by slight manipulation, and withdrawn, after which the ligature is drawn up tight, by which maneuver the entire site of the pile is included in the line of suture down to the point of the mucocutaneous junction.

If the incision has been at all extensive, it is well to knot it here and suture the skin incision outward by a separate line of suturing. In the less extensive cases, the original line of suturing can be made to include both the mucous and skin incisions without interruption. Thus the surgeon has secured himself from the dangers of hemorrhage by preliminary ligature of the vessels of supply ascending from above; the securing of all the tissues of the wound by suture has been provided for by the way in which the needle is passed successively through the tissues which were

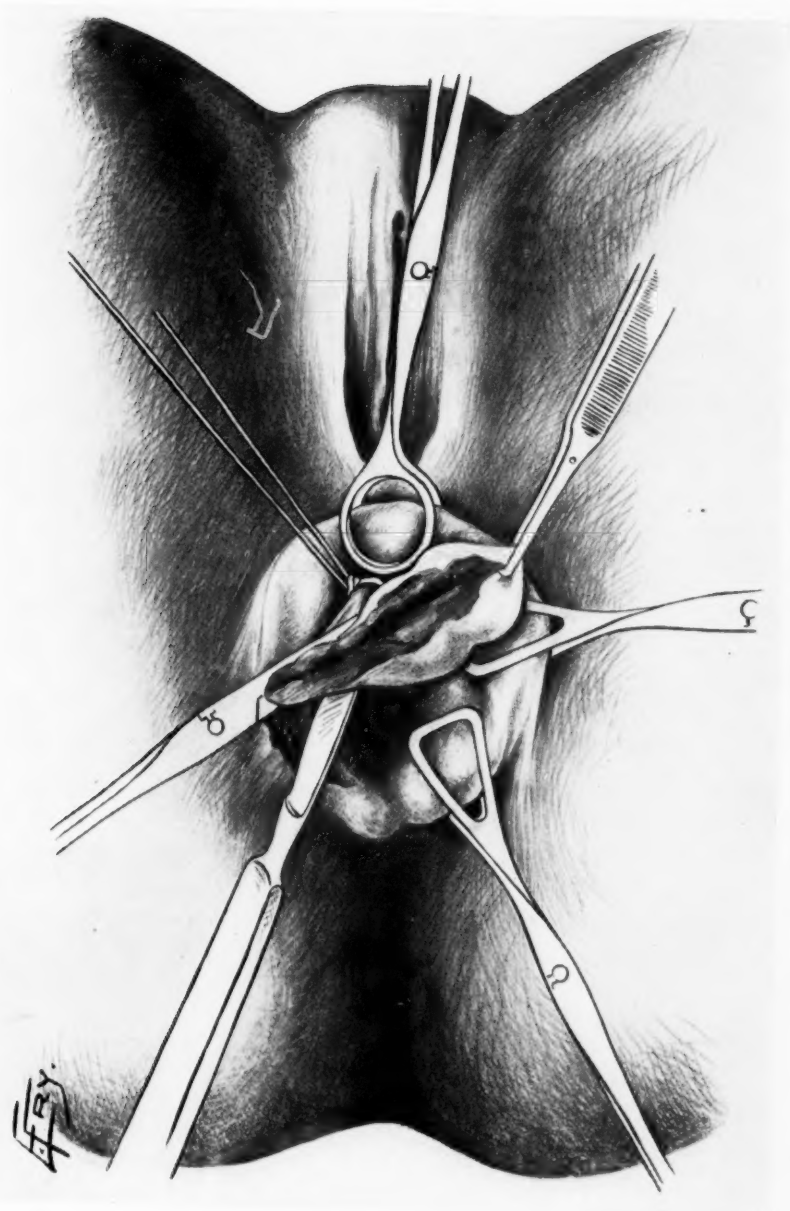

FIG. 5.—The hemorrhoid is cut away.

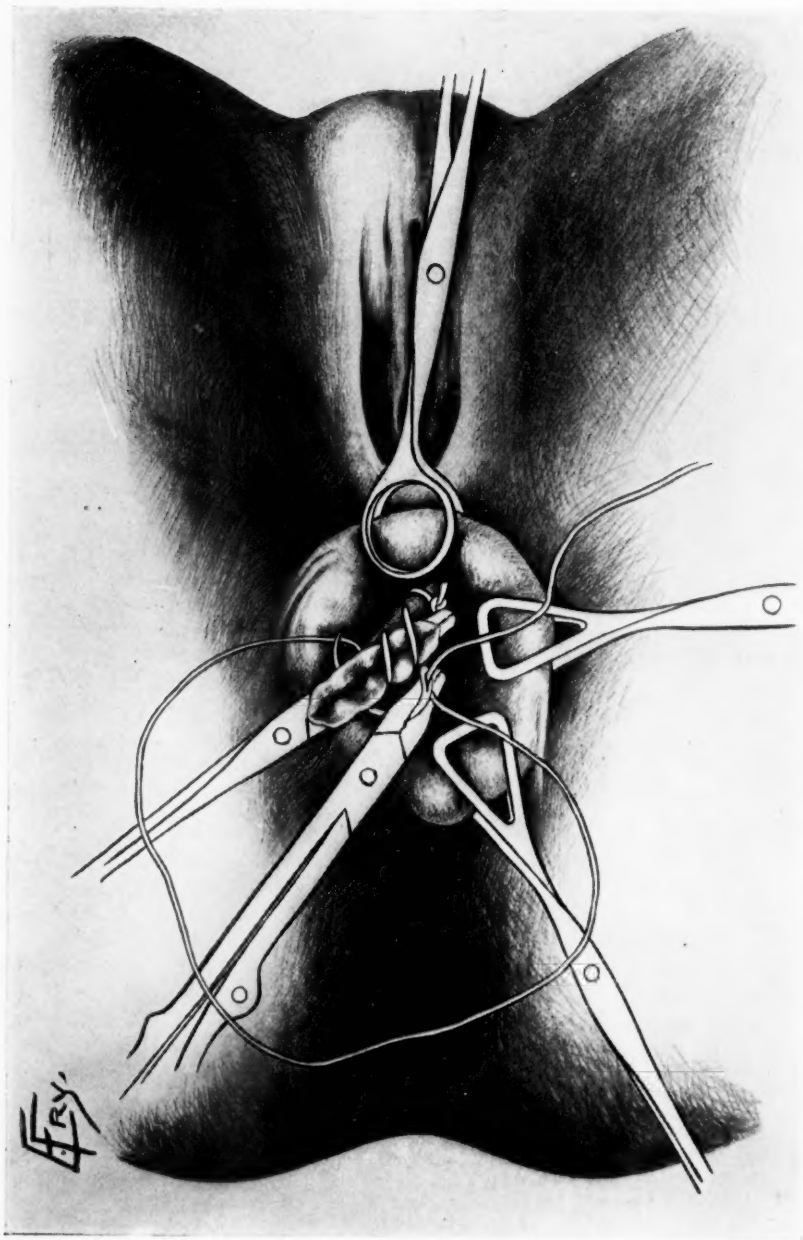

FIG. 6.—The ligature is passed as a running suture over the stump of the pile and beneath the grasping clamp.

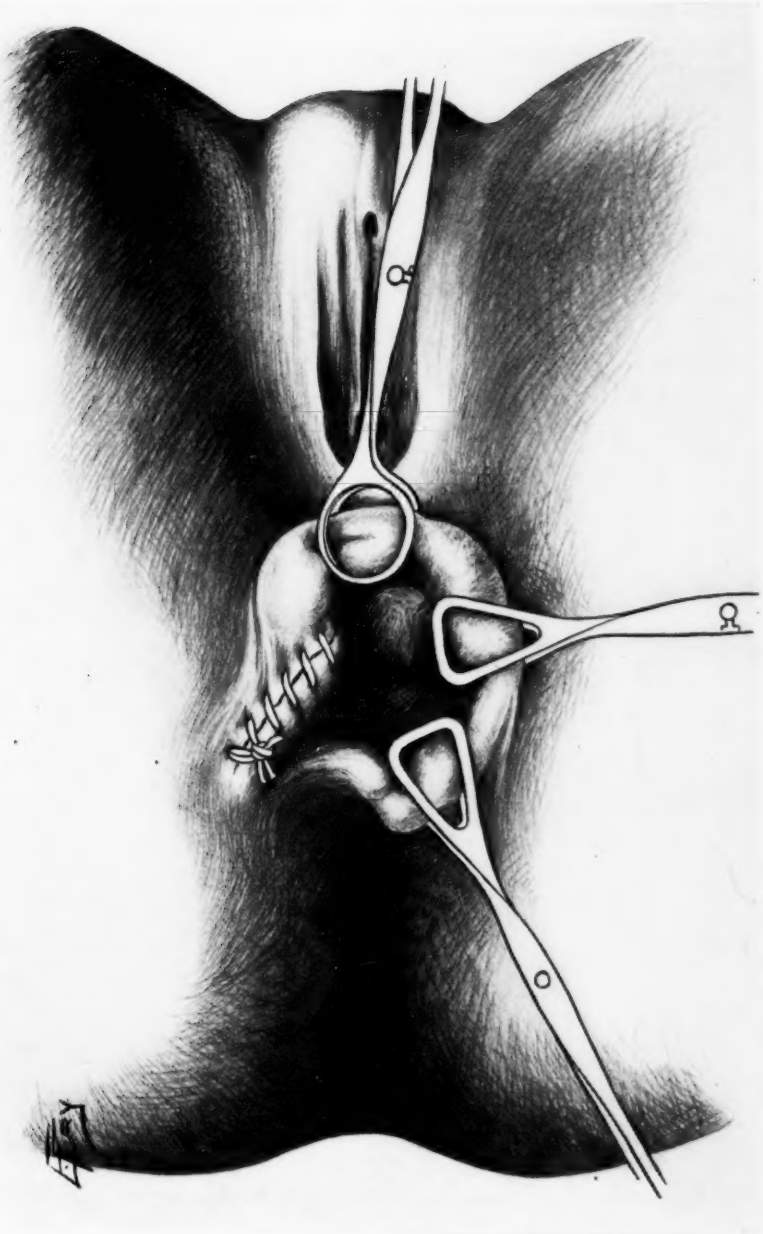

FIG. 7.—The clamp is removed, and the suture is drawn up and tied.

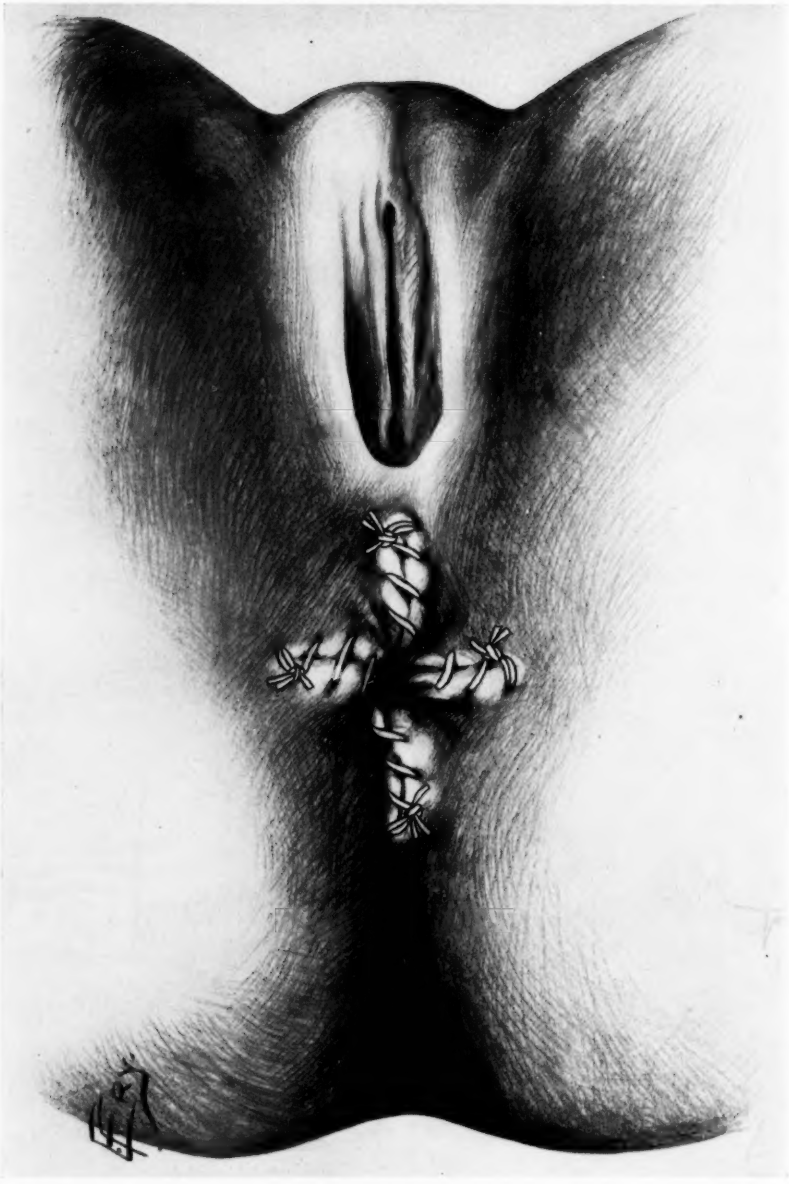

FIG. 8.—The completed operation, as presented after the removal of multiple hemorrhoids.

grasped by the clamp. It may be noted here that if the clamp is not applied with enough force there is the possibility that some of the tissues grasped in it may slip out after the cutting away of the pile mass; this should be thought of in the application of the clamp and the necessary strength of blade and force of grasp should be secured by the surgeon. My own experience, however, has been that even when such slipping of the cut parts has occurred, it gives but little trouble to secure them by suitable additional suturing, for the parts are well exposed to view and are thoroughly under control.

When the procedure has been completed there results a well- and satisfactorily-secured wound; the wound surfaces are in apposition, the perianal skin redundancies have been in great part removed, and the traces of the operation there present to inspection two, three or more small sutured wound-lines radiating from the anus. (Fig. 8.)

In my own experience, the after history of cases thus treated has been uniformly smooth; much less pain, either immediately following the operation, or later, has been complained of by patients than in other methods of operating. The tendency to the formation of hematoma or of œdematous swelling has been comparatively slight, and, thus far, wound infection has been escaped, although it is not to be denied that the work in all cases is done in an infected field, owing to the impossibility of perfectly cleansing the parts to be operated upon, or of preventing the subsequent access of fecal materials from above.

The simplicity of the method and its completeness as a surgical procedure have commended it to our judgment, as well as the satisfactory after-course and the completeness of the restoration of the parts to their original integrity.

The subsequent treatment does not differ from that commonly employed in any method of dealing with hemorrhoids. A suppository containing ¼ gr. of morphia, 1 gr. ext. hyoscyamus, 2 gr. iodoform, is inserted into the rectum, and a compress of iodoform gauze is applied against the anus

supported by a larger compress of ordinary gauze and a T-bandage. The bowels are kept quiet by moderate doses of tincture of opium until the third day, when a laxative is administered, the first movement produced by which is rendered easy by the administration of an enema of 6 oz. of olive oil.

The patient is allowed up at the end of one week.

THE TREATMENT OF ECTOPIA VESICAE.[1]

BY F. TRENDELENBURG, M.D.,

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THE repair of congenital defects of the urethra and bladder constitutes one of the most difficult and for that reason perhaps one of the most interesting chapters in plastic surgery, and if the outcome be successful it may be regarded with intense satisfaction. During the past fifty years many surgeons have occupied themselves with the solution of this problem, and many have been the attempts to devise a method by the aid of which, even in the severe types of the deformity, a restoration of the normal bladder form and normal bladder function could be secured. Up to the present time, however, this ideal has not been reached.

In passing I desire to refer very briefly to some of the essential facts in the history of this subject. In uncomplicated cases of epispadias Dieffenbach effected a cure by freshening the edges of the opening and then uniting them by direct suture. Where the cleft extended into the bladder itself, he regarded operative interference as practically hopeless. Thiersch then introduced a method by which the defect was covered with a neighboring skin-flap and it was he who first succeeded in producing in front of the bladder left everted an enclosed narrow space in which by the aid of a special mechanical contrivance which exerted pressure on the neck of the bladder, the urine could be retained.

For more than twenty years I have endeavored to aid the direct union of the freshened edges in cases of ectopia by producing a separation of the pelvic bones at the sacro-iliac synchondrosis in order to provide for a closer approximation of the two halves of the pelvis anteriorly at the

[1] Read before the American Surgical Association, May 30, 1906.

symphysis and consequently of the edges of the defect. Only a limited number of surgeons have made use of my method, because the bilateral separation of the os ilei from the sacrum was generally regarded as a very dangerous procedure, and the attempt to produce a bladder in this way which was capable of retaining some urine was not uniformly successful.

Although the latter fact cannot be denied, there is little occasion for fear as regards the separation of the pelvic bones in the manner indicated if the operation is done before the seventh or eighth year. In adults the procedure is undoubtedly much more difficult and dangerous.

In abandoning the attempts to restore a normal bladder cavity, recourse was again had to an idea first proposed by Simon, who suggested that the urine should be diverted into the lower portion of the intestinal canal. In this way there was developed the method now recognized by the name of Maydl, which is characterized by the implantation of the ureters into the sigmoid flexure. The continence which is thus attained may be made to extend over several hours. One of the dangers, however, which is associated with this method is the production of a pyelonephritis, from the entrance sooner or later of some of the intestinal contents into the ureters. Gersuny, Borelius, Mueller, Muscatello and Wehr have all suggested various ingenious modifications for obviating this difficulty, but none have succeeded in entirely overcoming it. And aside from the actual danger to life, the unnatural manner in which the urine must be voided per anum constitutes a great annoyance, particularly to patients of the male sex.

I am quite convinced, therefore, that the advent of Maydl's operation has in no way arrested the further development of plastic surgery in this field, but I believe that very probably ureteral transplantation will again be abandoned and recourse be had to direct suture of the edges of the deformity under discussion as the only means by which the normal relations can be restored. I myself have always

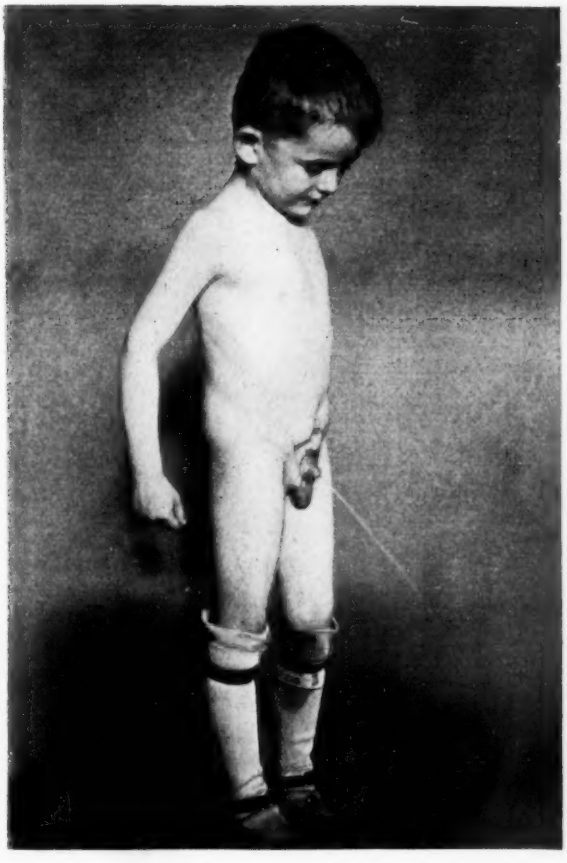

FIG. 1.—Result of operation for ectopia vesicæ after the method of Trendelenburg. Power of retaining urine, afterwards lost again.

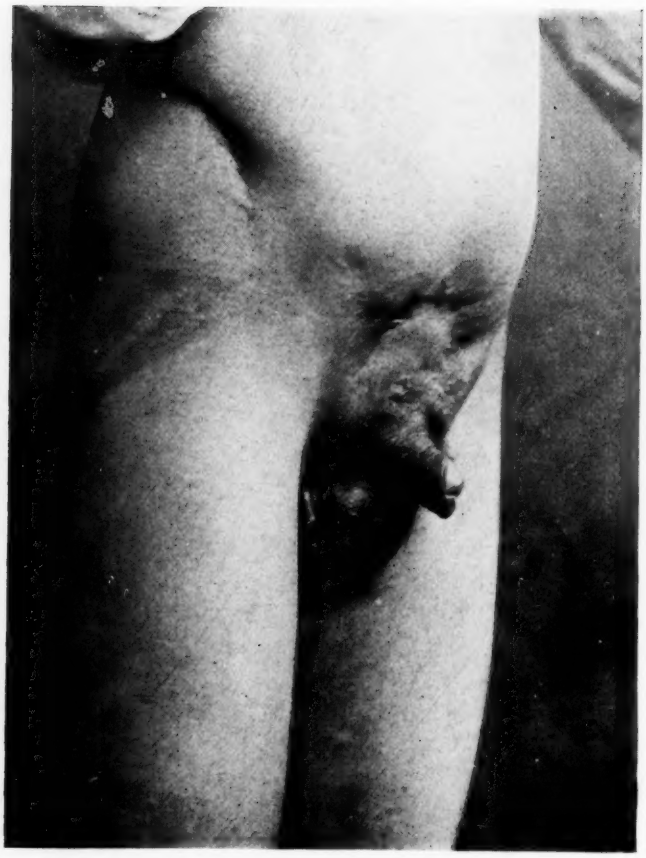

FIG. 2.—Result of operation for ectopia vesicæ after the method of Trendelenburg.

FIG. 3.—Epispadia with fissure of neck of bladder. Fissure of pelvis. Boy retained urine for two hours.

FIG. 4.—Ectopia vesicæ. Inguinal herniæ. Result of operation.

adhered to this plan, and I now ask your kind permission to describe what I have accomplished along these lines and in what respects I have failed.

As regards my cases of bladder ectopy which were operated upon years ago, I desire to say that there are two patients living whom I have had under observation almost continuously and a third who has been seen occasionally. In all three patients the defect, which extended from the umbilicus down to the glans penis, is completely closed and no fistulous openings are present. The form and shape of the penis itself are moreover quite satisfactory. The bladder when distended consists of a spherical cavity lined with mucous membrane over its greater extent. The passage of small concretions is occasionally observed by these patients but the tendency to calculus formation is by no means as marked as in certain cases operated upon by Thiersch which I have had occasion to examine. These patients partly suffered to such an extent from the production of calculi, incrustations and ulcerations in the irregular crypts of the bladder, that they demanded operation by some other method for the relief of their condition. (Figs. 1, 2, 3, 4.)

Retention of the urine is not complete in any of my three cases. These young men, therefore, wear a contrivance supplied with a small spring which compresses the urethra at the root of the penis either from the front or the back. The patients are now students in college; they are not greatly inconvenienced by the apparatus, and by proper care and attention they avoid the production of any odor which would serve to attract attention to their condition. If the spring is raised with the finger, the urine issues forth in a stream. On lying down it collects in the bladder without leakage. One of the men remains dry throughout the night, he may be awakened once or twice by the desire to urinate and even when he gets up he can voluntarily retain the urine for several minutes and then pass it naturally in a stream.

A fourth patient, a boy of five, could also, when he tried, retain his urine for several hours when standing or walking, but later on, at the time of his leaving the clinic, this ability was lost.

Both of the two cases last mentioned demonstrate that the physiological factors necessary both for retention and voluntary micturition are present, and that they are merely prevented from functionating in a normal manner by certain mechanical conditions. The reason for the failure may be accounted for by the fact that the two sections of the pelvis which have been separated at the sacro-iliac synchondrosis have a tendency to gradually resume their former positions, therefore the neck of the bladder and the prostatic portions of the urethra which are closely connected with the pubic bones, are pulled upon to such an extent that the muscular ring can no longer be brought into play.

I have made several attempts to overcome this difficulty by mobilizing the pubic bones with the help of the chisel or by dissecting widely the attachments of the urethra and the neck of the bladder to the latter. In no instance of complete ectopia have I been favored, however, with a permanent result. Such a procedure, moreover, is apt to lead to the production of a dense scar along the vesical neck, which in the event of a later secondary operation will be found a source of as great annoyance as the cicatrices in a harelip which has failed to heal by primary union.

In cases of epispadias associated with incontinence, as well as in patients who present only a partial ectopy involving merely the vesical neck, the prognosis is more favorable. In these transitional types between simple epispadias and ectopia vesicæ there is also lacking a proper union at the symphysis pubis, but the separation at this point is not so extensive and consequently there is much less lateral tension on the neck of the bladder and the urethra after operative closure.

It is well known that in certain cases of epispadias where the infundibulum is narrow, the previously existing

incontinence may be overcome by direct suture of the urethra after the free edges of the latter have been freshened. But even if the infundibulum is sufficiently large to admit the tip of the little finger and a slight prolapse of the posterior wall of the bladder follows either coughing or straining, there is still some hope that continence may be restored. It is merely necessary in such cases to bring about a narrowing of the muscular ring (around the neck of the bladder) by the excision of a sufficiently wide wedge-shaped section from the upper border of the infundibulum and then carefully closing the resulting gap with buried catgut sutures. If it is found after operation that the urine still fails to be fully retained, then it becomes necessary to repeat the procedure, a larger strip being taken than on the former occasion.

In cases marked by a broad infundibulum and a partial ectopy of the bladder it is advantageous to make use of the space between the pubic bones at the symphysis to gain approach to the vesical neck and the prostatic portion of the urethra, which may be thus more readily freed. A vertical incision is made through the skin over the region of the symphysis and carried down between the pubes to the anterior wall of the bladder and the infundibulum. By means of two strong sharp retractors the pubic bones may then be forced apart and through the space thus gained and with the patient in the elevated pelvic position, the trimming of the edges of the ectopic bladder and subsequent suture is greatly facilitated. Enough tissue should be removed to leave broad bleeding surfaces which may then be approximated with catgut sutures. In the region of the neck of the bladder the edges are turned in and brought together with a suture similar to that employed by Lembert for the intestine. The caliber of the new urethra is controlled by a small catheter previously inserted, but this should be removed at the close of the operation, otherwise it will exert a dangerous degree of pressure on the suture line. In place of it there may be substituted

a small drainage tube, which is inserted through a special opening made in the anterior wall of the bladder. The suture of the skin wound then completes the operation.

I obtained in this manner a perfect result with only a single operation in a boy of 12, to whom some of the photographs herewith presented refer (Figs. 5, 6, 7, 8). An X-ray disclosed the cleft in the pelvis, the pictures of the genitals show clearly the broad infundibulum; one picture was taken during the operation and another depicts the urinary stream during voluntary micturition.

A few years ago I also had an opportunity of operating upon a female patient for epispadias. In women, as is well known, this condition is much more infrequent than in men. Guetschow was able to find only thirty-five instances of this deformity reported in the literature. Strange to say there is no reference made in any of these cases to a cleft in the pelvis, although we must expect to find it, inasmuch as the condition is analogous to that in the male, and as in the severe cases a cleft of the bony structure is certainly always present. In the absence of an X-ray examination this feature may however escape notice. In a little girl of five, operated upon by myself, the separation at the symphysis amounted to three centimeters, and the picture of the external genitals was the usual one associated with epispadias of a marked degree. The labia majora and minora were separated above, and at the anterior end of each labium minus was situated a half of the divided clitoris. Above the hymen one could look directly into the infundibulum, the inferior wall of which was lined with the mucous membrane of the widely-gaping urethra. Through this infundibulum it was readily possible to introduce the little finger into the bladder. On straining, a small section of the posterior wall of the bladder came into view; years ago, according to the statement made by the child's parents, the greater portion of the bladder prolapsed through the opening. We had to deal, therefore, with an extreme degree of epispadias, but with only a partial ectopia of the bladder.

FIG. 5.—Epispadias with fissure of neck of bladder. Fissure of pelvis.

FIG. 6.—Epispadia with fissure of neck of bladder. Fissure of pelvis.

FIG. 7.—Ectopia vesicæ. Result of operation.

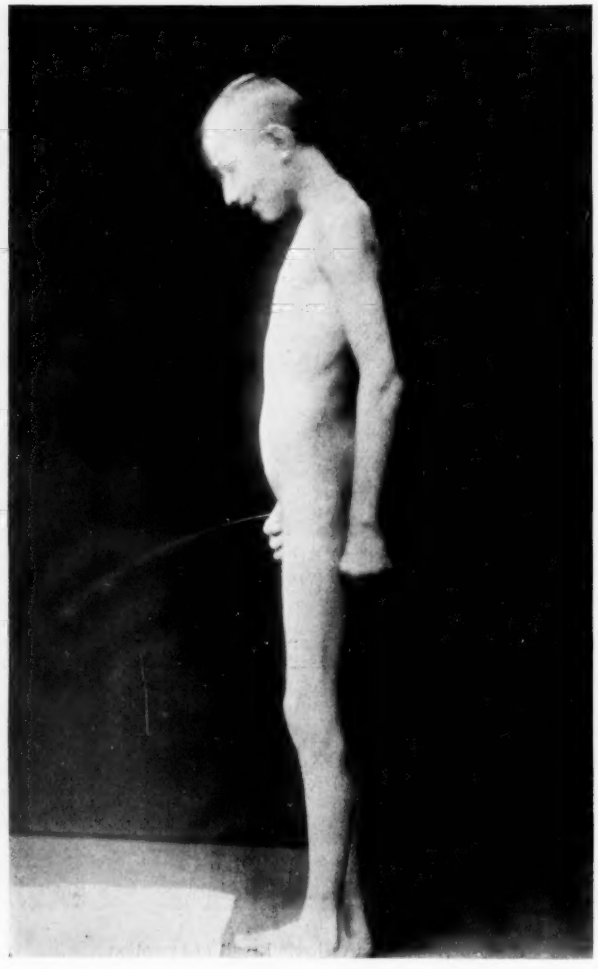

FIG. 8.—Epispadia with fissure of neck of bladder. Fissure of pelvis. Functional result of operation. Boy retains urine for two hours.

As there was a well-marked diastasis at the symphysis, and as a good union of both bladder and urethra was to be expected only if the lateral tension could be eliminated, the first step in the operation consisted of the bloody separation of the pelvic bones at the right sacro-iliac synchondrosis. It was found that this was sufficient to permit of the complete approximation of the two halves of the pelvis anteriorly. The freshening of the edges and the suturing of the cleft in the neck of the bladder was carried out just as in the previous case, and then the symphysis was wired. After healing took place, the incontinence continued because the urethra and the neck of the bladder were still too wide. The entire operation was therefore repeated a year later, the wire suture being first removed, the two halves of the pelvis forced apart, the urethra and the neck of the bladder incised and narrowed and the silver-wire suture finally replaced at the symphysis. The result of this procedure was continence during the day extending over several hours, and complete retention during the entire night. The wire suture was the cause of the production of a fistulous tract, but the latter closed when the suture which had already cut its way through the bone was extracted. And now after a period of six years the result is still perfectly satisfactory.

The question naturally arises, why was not a similar effect obtained in cases of complete vesical ectopia? The explanation may be found in the fact that it is impossible in these cases to bring together the pelvic bones in front and to keep them permanently in position. Wiring of the bones particularly in boys cannot be advantageously employed, because the wire comes in conflict with both the bladder and the penis. In younger children, moreover, the wire is very apt to cut its way through the tissues.

I am of the opinion that it would be wise to go back to the old idea advanced by Demme and Passavant and to make an attempt to bring about the desired changes in the bony structures of the pelvis by orthopedic measures. The rapidly-growing osseous tissues of the young do not offer

much resistance to even slight degrees of pressure provided it is constantly applied. The bone yields and gradually undergoes marked alterations in form and contour. Thus we find in cases of congenital macroglossia with prolapse of the markedly hypertrophied tongue, that the constant pressure of this soft tumor on the anterior portion of the inferior maxilla is such that in the course of years the middle section of the lower jaw assumes an oblique position and the alveolar process with the incisor teeth is turned entirely forward and downwrd. Ordinary soft mucous nasai polypi, if large or numerous, are liable in young individuals to dsplace the bony frame-work of the nose and thus to produce marked facial deformity. And the effect of constant though comparatively slight pressure intentionally applied to infantile bones is well illustrated by the feet of the Chinese women. The mother begins according to the statement of Perthes the treatment of her daughter's foot in her fourth to fifth year, applying a bandage twice daily in such a manner that the foot is held in a position of plantar flexion. The bandage causes so little pain that the child does not even cry and yet the treatment is so effectual that the growth of the foot is arrested to such a degree that complete fixation of this part in a position of abnormal plantar flexion results during the course of a few years.

There seems to be no good reason why with the exercise of time and patience the infantile pelvis may not be similarly molded in cases of vesical ectopia. Thus the mother may be directed to apply a snug and sufficiently wide ru bber band around the child's pelvis and hips for some definite period during the day and night. If this be supplemented by operative division of the pelvic bones at the synchondrosis it may be possible to bring together permanently in this manner the two halves of the pelvis and to convert the transversely placed oval defect of the abdominal wall into a narrow vertical slit. This would produce practically the same conditions which are present in epispadias associated with a partial ectopia of the bladder and we should then

expect to have the same satisfactory operative result as in the less severe types of the deformity.

Cases of vesical ectopia are quite rare and their treatment demands the exercise of much time and patience. It is only by the united labors of many investigators that substantial progress can be attained.

Perhaps my brief communication may be the means of stimulating further research in this country on the lines indicated, which I have come to regard as the only method which is likely to be rewarded by perfect results.

CONGENITAL PROTRUSION OF HEART, STOMACH AND SPLEEN.

CASE OF CELOSOMA.

BY CARL HERMAN WINTSCH, M.D.,
OF NEWARK, N. J.

ACCORDING to Hirst and Piersol, celosoma is a lateral or median eventration with fissure, atrophy or even total absence of the sternum and protrusion of the heart.

The anomaly of disposition in such a case is undoubtedly due to the defective union of component embryonic parts; the direct cause undoubtedly being the adhesion of the amnion to the embryo. In the case reported below, the external cleft producing a sternal fissure and the absence of the entire sternum and part of upper ribs, was undoubtedly due to the abnormal volume of the heart causing a cardiac ectopia.

The imperfect union of the thorax was prolonged into the upper part of the abdomen, with the stomach and spleen protruding through the opening. Remarkable to note that at the point of entrance of the umbilical vessels, which is prone to incomplete closure, the closure was complete.

April 15, 1906, I was called to see Mrs. H., age 38, and delivered her of a living male child, normal in every respect excepting for a *complete protrusion of the heart, stomach and spleen*.

Family History.—Parents of the father are living and healthy. He is 35 years of age, healthy, and a tailor by trade. He is the third child of fourteen healthy children born unto his parents.

The mother's father died of apoplexy at the age of 58. Her mother is still living and healthy, and gave birth to seven healthy children.

This is the fourth child born unto Mrs. H., all healthy and living excepting one; ages of children $8\frac{1}{2}$, 7, $4\frac{1}{2}$ years. One year

FIG. 1.—Congenital protrusion of heart and stomach, anterior view.

FIG. 2.—Congenital protrusion of heart and stomach, lateral view.

and a-half ago the 7-year-old child, a male, was run over by a heavy truck, crushing in the entire chest, and died twenty minutes after the accident, in his mother's lap on the way to the hospital. The mother works hard every day helping her husband in the tailor shop, besides doing her own housework. During the pregnancy with this child the mother did not feel as well as she did when carrying her other children. She felt miserable and tired, and felt more life than with the rest of her children.

During her sixth month of gestation she stumbled over a board in the yard, and fell flat on her abdomen, but felt no ill effects from the fall. She says she had an enormous appetite and that the abdomen was much larger in circumference than with her other children.

Labor began at 2 P.M. on April 14; pains became severe about 7 P.M., and child was born at 2 A. M. April 15th. The child was born before I arrived; and the labor seemed perfectly normal, excepting a small hemorrhage just before the birth of the child. The child weighed 7 lbs. 1 oz. and measured 19 inches in length. Respirations were 30 in number; pulse 120–130; temperature 97.8°. It defecated and urinated normally. It became very cyanotic at times, which was aggravated when pressing upon the heart with the hand. The child lived two days and three hours and was fed per mouth with water and milk from breast of mother, which it retained. Just before death the child vomited a greenish fluid, and bled from its mouth.

The heart was moistened every 15 minutes by a saline solution 99° F. applied to gauze covering the heart. The heart was entirely on the outside of the body, covered by the pericardium. The systole and diastole were distinctly noticeable. The stomach and spleen were covered by the peritoneum.

The accompanying photographs (Figs. 1, 2) were taken instantaneously while the child was living, and the heart in full action.

As far as I am aware, from search through the literature, this is the only case on record of a full term living celosoma.

CHEWING-GUM NUCLEUS OF VESICAL CALCULUS.

BY ED. B. KENNER, M.D.,

OF GALVESTON, TEXAS,

Formerly Demonstrator of Anatomy in the Missouri Medical College, and Assistant in Surgical Clinic at the St. Louis Polyclinic.

USUALLY the peculiar psychopathic condition that mpels a patient to introduce a foreign body into the urethra leads to secretiveness, but not so in this instance. The patient is a male, thirty-eight years old, a druggist by occupation and of fair intelligence. He applied to me immediately after the occurrence of the accident, now to be related, stating that he had been troubled for five or six years with a peculiar uneasiness in the deep urethra. He never had gonorrhœa or any bladder trouble, but six years ago had a fistula in ano, in the course of the treatment for which rectal bougies were used. This gave him the idea that something of the kind would relieve his urethral discomfort, so he had been using at intervals of every five or six months a piece of chewing gum on the end of a broom straw, which he would introduce into the urethra as far as the straw would go and then withdraw it; this he said would always relieve him of the peculiar feeling in the urethra. This chewing-gum straw bougie he had again attempted to use, but on this occasion the piece of gum had come off the straw when he attempted to remove it.

He was situated so that I could see him every day and not so that he could undergo an operation at once, so I explored the urethra and bladder with sound and cystoscope, and located the gum in the bladder and attempted to extricate it with a Bigelow's lithotrite, but only succeeded in breaking it into two pieces. One piece engaged in the urethra the next day and was voided with the urine during an act of micturition; the other piece remained in the

A piece of chewing gum showing calcareous deposits after remaining in the bladder sixty days.

bladder for sixty days, without giving rise to any trouble, except to temporarily check the flow of urine at times. At the end of this period I opened the bladder from above the pubis, and removed the remaining piece of gum. It was covered with an abundant phosphatic incrustation as shown in the figure. An uncomplicated recovery followed.

DISLOCATION OF THE METATARSAL BONES.[1]

BY LEONARD W. ELY, M.D.,

OF NEW YORK.

THE patient, an hotel porter, 45 years of age, presented himself at the Roosevelt Hospital Dispensary on February 10, 1906, and gave the following history:

One hour ago, while ascending on a freight elevator, standing on a trunk, he was caught by the left foot between the trunk and the edge of the side-walk. The foot was apparently flexed dorsally and compressed anteroposteriorly. The patient reached the dispensary with assistance.

Examination showed the heads of the second, third, and fourth metatarsals dislocated upward and outward on the dorsum of the foot, the head of the first metatarsal dislocated inward. The tarsus was, so to speak, shoved in between the metatarsals.

After a skiagram of the foot had been taken, the patient was shown by Prof. Brewer to his class, and was then anæsthetised. Under ether the dislocated bones could easily be replaced by pressure with the thumb, and could easily be redislocated.

A sole plate was made of plaster-of-Paris, running up behind the heel. This was strongly reinforced under the arch, and was prolonged on the internal aspect of the dorsum of the foot. To this splint the foot was tightly bandaged and strapped.

The splint was removed on February 21, and the heads of the metatarsals were strapped with adhesive tape.

Six weeks later the bones were in excellent position.

Stimson, in his book, mentions three cases of dislocation of the first four metatarsals, but in none of them was the displacement the same as in this case.

[1] Shown at the April Meeting of the Surgical Section of The New York Academy of Medicine, 1906.

TRANSACTIONS

OF THE

NEW YORK SURGICAL SOCIETY.

Stated Meeting, April 11, 1906.

GEORGE E. BREWER, M.D., in the Chair.

VANISHING TUMOR OF THE PYLORUS.

DR. HOWARD LILIENTHAL presented a man, 40 years old, who was admitted to Mount Sinai Hospital on February 5, 1906, in the service of Dr. Alfred Meyer. He was pale and emaciated, and had frequent attacks of vomiting. An inspection of the abdomen showed waves of violent peristalsis extending from the upper left side to the right iliac region. The abdomen was rigid. There was practically no temperature. A blood-count showed only profound anæmia. After an enema there was a fair movement of the bowels, with considerable gas, and the peristaltic movements ceased.

As the symptoms seemed to point to an intestinal obstruction, a small incision was made in the right iliac region, the place where the peristalsis seemed to come to a stop. Nothing abnormal was found there, but the palpating finger detected a tumor of the pyloric region, so a second incision was made higher up, which revealed a tumor of the pylorus fully as large as a duck's egg. It was freely movable, and was regarded as a carcinoma. The man's condition at the time was such that nothing could be done but a posterior gastro-enterostomy, which was completed by the suture method.

Sixteen days after the original operation, the patient's abdomen was again opened through the cicatrix of the upper

wound, with the intention of performing pylorectomy. During that brief period, however, the tumor of the pylorus had entirely disappeared. Not a vestige of it remained, and there was only the slightest suspicion of thickening around the pylorus. No treatment had been given in the interim.

Dr. Charles N. Dowd said that several years ago he reported before the Society a case which was almost the exact counterpart of the one shown by Dr. Lilienthal, but that the subsequent history of this case was also worthy of attention. The patient, a young man, had all the signs of pyloric obstruction, with extreme emaciation. Upon opening the abdomen a firm tumor of the pylorus was found, about as large as a hen's egg. It appeared to be malignant, but on account of the patient's extremely weak condition a gastro-enterostomy was done, in the expectation of doing a pylorectomy at a later time. At the subsequent operation, however, no signs of the tumor of the pylorus could be found, and therefore the pylorectomy was not done. About eighteen months later the man died from perforation of the stomach, due to a diffuse cancer of the pylorus, and on autopsy all the tissues in the vicinity were found involved by cancerous infiltration.

Dr. Dowd said that it was difficult to explain these temporary pyloric tumors, but suggested that œdema which was due to the presence of an ulcer, or possibly a beginning cancer, must be an important element in their formation.

Dr. Arthur L. Fisk said that six years ago, he was asked to see a gentleman who was supposed to have cancer of the pylorus. The man was greatly emaciated, very feeble, and cachectic, and had a tumor in the epigastrium the size of an adult fist. The diagnosis was made by two of the best physicians in New York City, and the family were so informed. No operation was performed; the tumor gradually disappeared, and the man is living still, in excellent health, at the age of 84. Nothing can be palpated in the epigastrium which is suggestive of a tumor, or even thickening.

Dr. George E. Brewer said that in Dr. Dowd's case the lesion was perhaps a pyloric ulcer, with the subsequent development of cancer. In connection with the cases that had been spoken of, Dr. Brewer said he wished to report a case of tumor of the sigmoid which, upon operation, he regarded as an in-

filtrating carcinoma. The condition seemed to be inoperable, and he limited himself to a colostomy. Eighteen months later the man returned to have his colostomy wound closed, and upon opening the abdomen it was found that the supposed carcinomatous mass had entirely disappeared. It was probably a gummatous tumor, as the patient subsequently gave a history of persistent headaches, which had disappeared under the use of potassium iodide.

Dr. Lilienthal said that his patient had received no anti-syphilitic medication whatever after the operation. The mass at the pylorus might possibly be explained by assuming that the man had an ulcer, with a minute perforation and œdema, and the pouring out of an enormous quantity of lymph. The gross appearance of the mass, however, was certainly that of carcinoma.

As a possible aid in the diagnosis of these cases, Dr. Lilienthal said, the fact should not be lost sight of that large carcinomatous growths in the peritoneal region usually, though not always, invaded neighboring organs. If sufficient time had elapsed to allow the growth to attain considerable size, the probabilities were that there would be adhesions, and that adjacent structures would be invaded. In the absence of such manifestations, the malignant nature of the growth might be looked upon as doubtful.

ACUTE DIFFUSE SUPPURATIVE PERITONITIS.

Dr. Benjamin T. Tilton presented a boy of 7 years, who, while being treated at the Willard Parker Hospital for scarlet fever, on the fourth day of that disease developed acute abdominal pain, followed by vomiting. He was kept under observation for twenty-four hours, and then transferred to Bellevue, the case being regarded as one of acute peritonitis.

At the time of his admission to Bellevue the abdomen was very much distended, with marked rigidity and tympanites, and general abdominal pain. The temperature was 102.8, pulse 130. The vomitus consisted of greenish material. An immediate operation was done, and on opening the abdomen in the median line, free pus was found throughout the peritoneal cavity. The appendix was found free from adhesions and not markedly enlarged. It was not removed. On the left side of the abdomen an abscess was found localized among

coils of intestine. The abdomen was irrigated and drained. The patient's condition was so bad that he almost died on the table. He was placed in the Fowler's position. Four hours after the operation the boy's temperature was 101.8; pulse, 142; respiration, 52. On the following morning his condition had remarkably improved, and from that time on the case went on to uninterrupted recovery. Five weeks had elapsed since the operation.

THE TREATMENT OF DIFFUSE SUPPURATIVE PERITONITIS FOLLOWING APPENDICITIS.

Dr. Lucius W. Hotchkiss read a paper with the above title (for which see page 197).

Dr. Joseph A. Blake said the method of treatment of these cases, as outlined by Dr. Hotchkiss, was practically the same as that followed in his own work, and, so far as he knew, it was the best way. The speaker said he always inserted the drain into the peritoneal cavity, so as to carry off all excess of fluid. The work of Ochsner in this field of surgery was very valuable and instructive, and was confirmatory of Dr. Hotchkiss' method of treatment. Ochsner employed no drainage, and the diseased appendix was left in; if that organ was removed there was even less need of drainage. The modern tendency was to drain as little as possible, as it was well known that the introduction of a drain into the peritoneal cavity was fraught with great danger, and in the old days, when free drainage was resorted to, the patients almost invariably died.

The method of drainage recently suggested by Murphy, Dr. Blake said, was in some respects similar to the older form of treatment, its object being to remove the products of inflammation in the peritoneal cavity through an opening in the lower part of the abdomen. This to a certain extent did away with the necessity for the ordinary methods of drainage, but the same result of removing these products of inflammation could be accomplished by proper irrigation. The introduction of a certain quantity of hot saline solution into the abdominal cavity acted as a stimulant, but if continued for too long a time it was apt to produce shock. It should not be continued for over five minutes at a time. The amount of ether given these patients

should also be limited. After the peritoneal cavity had been cleansed as thoroughly as possible, a minimum amount of drainage should be employed, but if necrotic material had to be left behind in the abdomen, it should be isolated and drained.

Dr. Blake said that since he had used solutions of magnesium sulphate in the spinal canal, and had become better acquainted with the effects of the drug, he had felt less inclined to introduce it into the intestine following operation. In certain conditions it might fail to produce an evacuation, and by absorption might give rise to poisonous effects. He had recently heard of such a case in Boston.

Dr. Lilienthal said that at the outset it was important to define what constituted peritonitis. The mere fact that pus was occupying every crack and corner of the peritoneal cavity did not constitute a peritonitis. The presence or absence of other symptoms was important; namely, whether the tongue was dry or moist, whether there was paralysis of the intestine, whether the patient was clear in his mind, whether there was a septic nephritis, etc.

Discussing the anatomical phase of the subject, Dr. Lilienthal said it had appeared to him that the so-called diffuse peritonitis was a less serious condition than that form in which there were multiple abscesses throughout the peritoneum. He recalled one case, however, in which he opened five such abscesses with good result.

Dr. Lilienthal said that most surgeons were in accord that in the treatment of septic peritonitis the abdominal incision should be a small one, a minimum amount of the anæsthetic should be used, and the offending cause, if possible, should be removed. There was a difference of opinion as to whether the abdominal cavity should be irrigated or not. In one case, an irrigation continued for five minutes might prove a dangerous procedure, while in another irrigation for even a single minute would be contraindicated. Personally, the speaker said, he did not irrigate at all, no matter how much pus was there. He recalled one case where on opening the abdomen he found a gangrenous appendix, with an enormous quantity of free pus in the peritoneal cavity. The appendix was removed, and deep drainage introduced through the pelvis. The abdominal cavity was not irrigated, but with every inspiration there was a flow

of pus through the tube. The patient made a good recovery. Dr. Lilienthal said that in spite of the good results obtained by Dr. Blake and others who favored irrigation in these cases, he thought their results would be still better if they dispensed with irrigation. The speaker said he was formerly very enthusiastic in his advocacy of the value of irrigation, but now he was opposed to both irrigation and drainage, restricting the latter to those cases where the Fowler position was used, as there he thought the drain prevented the formation of secondary abscesses in the pelvis. With that one exception, and perhaps even without it, he was in favor of dispensing with drainage entirely, restricting himself to sewing up the greater part of the wound and putting in a drain just inside of the peritoneum—just enough to get rid of the overflow.

Dr. Lilienthal said it was the practice in his service at the hospital to take a culture from the free peritoneal fluid in these cases, and if the streptococcus was found, the case was regarded as a much graver one than were the usual forms of peritonitis.

Dr. Fisk said that Mr. Herbert J. Paterson, in his Hunterian Lecture, published in the London *Lancet*, March 3, 1906, discussed this very question, and advocated removing the cause of the trouble, sponging out the space behind and above the liver only, sucking out, with as little disturbance as possible to the intestines, any fluid in Douglas' cul-de-sac, and establishing early intestinal peristalsis.

Dr. Fisk said that among the earlier cases of this kind that were operated on at the Massachusetts General Hospital, when he was an interne there, irrigation was done hourly for many hours, and most of the patients died. The speaker said he had entirely discarded irrigation; that he now removed the appendix, very gently but thoroughly dried out the pelvis with gauze sponges wrung out in warm salt solution, and then inserted a cigarette drain to the stump of the appendix. The results of that method had thus far been very satisfactory. The Fowler position was maintained for some days.

Dr. Hotchkiss said the entire discussion centred about one point, which was the logical crux of the situation, and that was, whether irrigation of the peritoneal cavity was beneficial or harmful? Whether it was wise in these extensive cases to remove, by irrigation, part of the highly albuminous exudate,

which was relatively slow of absorption, and replace it by saline solution, which was more rapid of absorption? The insertion of a drainage tube into the pelvic cavity of course removed the pus that was there at the time, but in the course of a very few hours, the drainage would be closely limited by adhesions and we could not drain the peritoneal cavity within.

Personally, Dr. Hotchkiss said, he did not regard the irrigation as all important. There is bound to be considerable difference of opinion among surgeons as to the method of treating these cases. If we could safely omit the irrigations, well and good. It had been demonstrated in his own experience that we could omit drainage, if we would wash out some of the purulent fluid. Whether both drainage and irrigation could properly be omitted in some of these cases was still an unsettled question.

DR. LILIENTHAL asked Dr. Hotchkiss whether he would resort to drainage in a case of peritonitis, with free pus in the peritoneal cavity and a necrotic abscess surrounding the appendix? Personally, he thought that such an abscess should be drained. He was willing, however, and he intended in his future cases to omit pelvic drainage; he was inclined to agree with the reader of the paper that irrigation was nothing more than one form of drainage.

DR. HOTCHKISS, in reply to Dr. Lilienthal, said that if there was a localized necrosis which could not be removed, it should be packed until it came away. In cases where the gangrenous appendix could be removed, entirely and cleanly, he did not drain at all.

DR. HOTCHKISS said it was generally agreed that at least a great part of the exudate in these cases was the result of a conservative process on the part of nature to repair the damage that had been done, and it was not only wise to retain it there, but it was impossible to entirely wash it away. By rapid irrigation, he thought we washed away some of the highly albuminous purulent fluid, which was slow of absorption, and sometimes harmful, and replaced it by a weaker solution, which was more rapidly absorbed.

TRANSACTIONS

OF THE

PHILADELPHIA ACADEMY OF SURGERY.

Stated Meeting, held April 2, 1906.

The President, JOHN B. ROBERTS, M.D., in the Chair.

TRAUMATIC INTUSSUSCEPTION.

DR. FRANCIS T. STEWART reported the case of a man, aged 30 years, who was struck just above the crest of the left ilium by a heavy steel beam. Shortly afterwards he was admitted to the Germantown Hospital in the most profound shock. At the end of 20 hours his temperature had risen to normal and the pulse had fallen to 110. He had vomited twice and passed 12 ounces of bloody urine. There was great pain all over the abdomen, a large hæmatoma in the left loin, and intense rigidity of the abdominal muscles. Liver dulness was decreased by three finger-breadths, and no dulness could be detected in the flanks. The abdomen was opened in the middle line below the umbilicus and a large extraperitoneal extravasation of blood found extending from the bladder, whose walls were infiltrated with blood, to the left kidney, which was normal to palpation. The abdominal muscles on the left side were torn from the left iliac crest. The peritoneal cavity was opened and found to be clean; there was no visceral rupture. In numerous places the small intestine was tightly contracted, the areas involved varying greatly in extent, so that in certain regions the intestine seemed to be ligatured, while in others it resembled a piece of tape. In one place the contracted intestine had passed into

the relaxed segment below for a distance of two inches. The intussusception was reduced, the peritoneal cavity closed and the extraperitoneal tissues drained. The patient died four hours later of shock.

Dr. Stewart observed that every surgeon has probably been struck by the tetanic contraction of portions of the intestine in traumatic cases, and has conceived the possibility of a traumatic intussusception, but of this there is no record. Attention, however, has been called to the fact that this muscular contraction may prevent the escape of intestinal contents for some days, even when the bowel has been completely divided. In some cases areas of dulness due to the contraction of large segments of bowel may be detected before operation. It may be that in some cases of transient intestinal obstruction after laparotomy for nontraumatic conditions the lesion is a spastic stenosis due to the necessary violence of the operation.

Dr. Robert G. Le Conte briefly described a case he had seen eight years ago which resembled in many points the one reported by Dr. Stewart. A boy of nine was stabbed in the left side of the abdomen, the wound penetrating to the peritoneum, as shown by omental protrusion. Under ether the abdomen was opened and a careful search of the intestine did not reveal any injury. Considerable hæmorrhage had taken place into the abdominal muscles, and also in the peritoneal cavity, from some large vessel which had been severed in the rectus muscle. While searching the intestine for a wound a direct intussusception about an inch long was found about the middle of the small gut, and two or three feet lower down two more were found, one direct, the other retrograde, each about three-fourths of an inch in length, while the sheath or intussuscipiens covering them was probably two inches in length. These intussusceptions resembled in appearance the kind so frequently observed at post-mortem examinations. There was no sign of inflammation, no congestion or change of color in the gut or mesentery, the peritoneal coat was normal in appearance, and reduction was accomplished with very light traction. Treves, in his work on intestinal obstruction, divides invaginations into two great forms, according to the circumstances of their origin: (1) The common or obstructive intussusception, and (2) the intussusception of the dying.

The latter form he attributes to certain irregular peristaltic movements which may be conceived to occur during the act of dying, either from changes in the circulation or from irregular stimulations of the vagi nerves. Such intussusceptions may form many hours after death, as is well illustrated in the case of Rurah (Archives of Pediatrics, April, 1896). While making an autopsy twenty hours after death on the body of an infant he saw an intussusception of the ileum form, and on handling the intestines other portions of the ileum began to invaginate themselves, so that in a few moments the entire small gut had become a mass of intussusceptions varying from 5 cm. to 10 cm. in length.

In the case reported by Dr. Stewart, and in his own, the intussusceptions present resembled in all particulars the so-called moribund invagination, and not the obstructive intussusception.

Three theories present themselves as a possible explanation: 1. The mechanical injury to the abdomen (the blow). 2. Hæmorrhage which may produce local changes in the circulation of the intestine or irregular stimulation of the nerves controlling peristalsis. 3. Opening the abdomen and handling the intestines while searching for the wound. This latter would seem the most probable cause.

GALL-STONES WITH ACUTE SUPPURATIVE PANCREATITIS.

Dr. Stewart related the case of a man, aged 51 years, who had suffered with attacks of indigestion for many years. February 25, 1906, he entered the Pennsylvania Hospital in the service of Dr. Le Conte. He had been ill for three weeks with severe epigastric pain, particularly after eating. There had been no vomiting or jaundice, but the temperature fluctuated irregularly, sometimes reaching as high as 103°. The epigastric muscles, especially on the right side, were rigid, and Dr. Thornton, who had had charge of the case, thought that at a previous examination he could feel an indefinite mass; he advised operation, believing the patient to be suffering from cholecystitis, with possible involvement of the pancreas. The urine was normal. At operation the gall-bladder was found tensely distended, the common duct unobstructed, and the pancreas

hard, lobulated and several times its normal size. There were no adhesions, and the stomach and duodenum showed no pathological change. The gall-bladder was opened and drained; it contained three large gall-stones and a mixture of bile and mucus which proved to be sterile. The cystic duct was filled with a quantity of a sand-and-putty-like material. Two days after operation the patient became slightly jaundiced, and between this time and the second operation he had three chills. The tube drained between one and two ounces of muco-bile during the course of each twenty-four hours. The bowels moved regularly and were always colored. On the eleventh day the abdomen was opened through a separate incision to the outer side of the original incision, which had become infected. The pancreas seemed to be in the same condition as at the previous operation. Some sandy material had lodged in the distal end of the cystic duct and could only be removed by excising a portion of the duct. A probe passed into the hepatic duct and down in the common duct revealed no obstruction, and these ducts were empty and collapsed. The patient died three days later, the jaundice becoming more intense, but the fever not recurring. At the post-mortem no obstruction was found in the ducts, but the head of the pancreas contained an abscess cavity holding perhaps two ounces of pus, which proved to be caused by the colon bacillus. There was a septic phlebitis of the portal vein and miliary abscesses in the liver. The remaining abdominal organs and the heart and lungs were normal. Quénu and Duval have collected 118 cases of pancreatitis coexisting with cholelithiasis. Of 104 cases in which the seat of the stones was stated, in 56 the common duct was involved, while in 46 the calculi were in the gall-bladder or cystic duct. A study of the relation of the location of the stones to the variety of pancreatitis shows that the chronic form is most frequently associated with lithiasis of the common duct, the suppurative form with calculi in the gall-bladder, and the hæmorrhagic variety with stones in the ampulla of Vater. In 72 cases there was a history of infectious or retention jaundice. Of the 118 cases, 20 were hæmorrhagic, 27 suppurative, 63 chronic, one cyst of the pancreas, and 7 reported as pancreatitis without any other epithet. In the great majority of the acute cases the process was localized to the head of the gland. Abscess of the lesser per-

itoneal cavity and phlebitis of the splenic or portal vein were common. In 20 cases there was a disseminated fat necrosis.

Pancreatitis developing in the course of biliary lithiasis is generally regarded as a complication. The relation is easily explained when the common duct is involved. The infection spreads by contiguity to the head of the pancreas, by continuity along the pancreatic duct, or it invades the intrapancreatic lymph-glands. Obstruction at the duodenal papilla may cause pancreatic stasis and regurgitation of infected bile, while a stone lodged in the pancreatic segment of the duct may compress the canal of Wirsung and lead to pancreatic retention, thus predisposing to infection. The passage of a stone by dilating the ducts favors an ascending infection from the duodenum, the contents of which are rendered more septic by the absence of bile. There is no satisfactory hypothesis for the occurrence of pancreatitis in cases in which the stones are lodged in the gall-bladder. Desjardins suggests that the initial infection in these cases is an ascending one which causes cholelithiasis and pancreatitis contemporaneously. Probably in some cases there is absolutely no relation between these two affections. The operative mortality in five hæmorrhagic cases was 100 per cent.; in 16 suppurative or necrotic cases, 50 per cent., and in 62 chronic cases almost 13 per cent. In acute cases the pancreas should, of course, be drained. In the case reported above, the induration felt at the time of operation was thought to be due to chronic inflammation, and this may have been true, the suppuration occurring subsequent to the cholecystostomy. The same course was taken in five of the 21 operations for acute pancreatitis reported by Quénu and Duval, with death in each instance.

SARCOMA OF THE OVARY.

Dr. Stewart related the case of a woman, aged 31 years, who was admitted into the Polyclinic Hospital, February 26, 1906. About two years ago the patient noticed a small, painful lump in the right iliac region. The tumor gradually increased in size until at present it almost fills the abdomen. There are irregular attacks of sharp pain which have been so severe during the past two weeks that the patient has been

unable to work. The menses began at twelve, are always regular, and last from two to three days; they are more painful but no more profuse since the lump was noticed. There has been no loss of weight or symptoms referable to the digestive or urinary apparatus. The tumor is hard, smooth, symmetrical, and slightly movable with the respirations and on pressure. Pulsation and bruit are quite distinct over the whole growth. There is no œdema of the legs. There is a patch of tympany behind the tumor in the left flank, and dulness in the right flank, giving way to tympany when the patient turns on the left side. The growth was removed through a median abdominal incision about eight inches in length. There were no adhesions and but little fluid in the abdominal cavity. The pedicle attached to the right horn of the uterus was about three inches in diameter. The left ovary, which was about four inches in diameter and cystic, was also removed. At each point where the aneurism needle had been passed through the pedicle of the tumor there was free bleeding. An attempt was made to control this by sutures, but each additional needle puncture also caused bleeding, so that a piece of gauze was pressed against the bleeding points and allowed to remain in place. The patient suffered little shock and reacted promptly without vomiting. At the end of thirty-six hours she quietly began to regurgitate stercoraceous material. Under ether the gauze was removed and a slight kink in the bowel straightened; this did not appear, however, to be sufficiently great to produce obstruction. The patient did not vomit for the succeeding twelve hours, at which time the stercoraceous regurgitation recurred. There was no pain, no fever, and no active peristalsis, although the bowels moved once by enema. The incision was reopened and the entire intestinal canal found moderately distended and motionless. There were no evidences of peritonitis or obstruction. An artificial anus was established by anastomosing a rubber tube to the bowels by means of a Murphy button, but there was absolutely no drainage from the tube until the time of death, which occurred twenty-four hours later. The lesion was probably an intestinal paralysis caused by the sudden relief of long-continued pressure.

The tumor weighs 2830 grammes. Microscopic diagnosis, round-celled sarcoma. Left ovary, angiosarcoma.

PERFORATING TYPHOIDAL APPENDICITIS.

Dr. John B. Roberts reported the case of a boy of nine years, who was admitted to Dr. James Hendrie Lloyd's ward of the Methodist Hospital on January 5, 1906, with symptoms of typhoid fever. The illness was said to have begun seven days previously, when he went to bed with severe headache, but he had had no nose-bleed or pain in the back. There was no cough, and no diarrhœa. When he was admitted to the hospital his tongue was coated; temperature 104°; respiration 26; pulse 108. The abdomen was flaccid, showed no rose-colored spots and was not tender on pressure. The blood obtained on the day of admission gave a positive Widal reaction, and on January 7th rose-colored spots appeared on his abdomen. His urine showed a specific gravity of 1020, contained no albumen or sugar, and gave the diazo-reaction. The white blood-corpuscles numbered 5600. The hæmoglobin was 80 per cent. The heart and lungs and other viscera showed nothing special, except that the spleen was palpable.

On January 8th the general condition of the patient was good. There was no pain or tenderness in the abdomen. The morning temperature was 102°; pulse 96; respiration 24. In the evening the temperature rose to 104°, with pulse 120 and respiration 24.

In the early morning of the 9th, the patient, after being sponged, complained of pain in the abdomen, and a little later had a distinct chill. His temperature dropped to 100.6°, but subsequently rose to 103°, which was followed by free perspiration and a rapid drop during the evening, until at midnight the temperature was 98°, with pulse 110; respiration 24. During the time of this fall of temperature the patient had marked diarrhœa, with a large amount of mucus, but no blood. The pulse was not altered very much in frequency, but during the period of perspiration the patient seemed weak and the pulse varied somewhat in quality. The patient looked white, and vomited. A blood examination made at midnight by the resident physician, Dr. L. L. Powell, showed 44,480 leucocytes. At 3 A. M. of the 10th the patient's temperature was 97.8°, though the pulse was only 104 and the respiration 24. The patient's facial expression was bad, and there was pain in the abdomen, with marked tenderness, and with rigidity on the right

side. Symptoms of perforation seemed sufficiently positive to warrant operation; and Dr. Roberts opened the abdomen about six o'clock in the morning, making an incision 6 cm. long, through the right rectus 2 cm. to the right of the umbilicus, beginning 3 cm. below the level of the umbilicus. The incision ran obliquely downwards and toward the middle line. On opening the peritoneal cavity a small amount of pus was found, but no fæces, among the intestinal coils. It was rather thick and did not have the colon-bacillus odor. The appendix was somewhat swollen and congested, and showed a small perforation near its junction with the cæcum. The lower three feet of the ileum were inspected, but no perforation was found. The peritoneum of the intestine did not show any discoloration to indicate where the inflamed Peyer's patches were situated. There was no marked congestion of the intestine, and no enlarged mesenteric glands were seen. The cæcum and the first eight inches of the large bowel were examined, but showed nothing abnormal. There were no adhesions about the appendix or the examined intestines. The perforated appendix was excised, and the stump touched with carbolic acid and dropped into the abdomen. A large rubber drainage tube was inserted in the iliac fossa and iodoform gauze placed around it in the wound. Examination of the pus removed from the abdominal cavity showed a few diplococci.

The child's temperature remained at about the normal point for some thirty hours after operation, then began to ascend in a characteristic typhoid-fever curve. A blood examination made the evening of the day of operation gave the positive Widal reaction and showed a leucocytosis of 17,760. The drainage tube was pumped out by means of a syringe every few hours at gradually longer intervals and was finally removed on January 21st. A leucocyte count on January 16th showed that the number of leucocytes had decreased to 7,650. For two or three days after operation there was considerable abdominal distention, which was relieved by enemas of asafœtida. The patient convalesced without interruption, and on February 28th was discharged from the hospital.

Dr. Roberts said that it was well established that the appendix is very frequently the subject of pathological changes during the course of typhoid fever; and that these lesions are

similar to those found in the lymphatic structures of the mucous membrane of the rest of the intestine. This may with propriety be termed typhoidal appendicitis. Then there are cases of typhoid fever in which appendicitis occurs from pyogenic infection, just as it may in healthy persons. Kelly and Hurdon discuss these conditions with great fullness. Deaver also devotes much attention to appendicitis coincident with, and caused by, typhoid infection.

In the matter of treatment these authorities are practically in accord. They believe that appendicitis developing in the course of typhoid fever does not call for operative treatment unless the symptoms are urgent. The access of symptoms of perforation or other grave accident demands prompt surgical interference, in their opinion; but otherwise an expectant policy under surgical supervision is advocated. When surgical intervention is evidently needed, it is to be adopted promptly and carried out with celerity.

VOLVULUS OF THE SMALL INTESTINE IN TYPHOID FEVER SIMULATING PERFORATION.

Dr. John B. Roberts read a paper with the above title (for which see page 242).

Dr. Gwilym G. Davis took exception to Dr. Roberts's statement that perforation of the appendix is more fatal than is perforation of the intestine in typhoid fever; the mortality of the former is generally placed at 50 per cent.; that of the latter, 75 to 80 per cent. One would naturally expect this difference, because if there is a typhoid ulcer of the appendix the patient is very sick of typhoid *per se*; if the appendicitis is separate, then the patient so far as the typhoid is concerned may be in good condition. Then again the appendix is situated at one side of the abdomen and toward the posterior wall, and is at least partly covered by intestines. For these reasons extravasated material from this organ is less apt to extend widely. In typhoid fever the perforation is usually at least a few inches or a foot from the ileocæcal valve, if not in the middle of the abdomen. The fæcal material passes out among the coils of the intestine, adhesions do not form, and general peritonitis is the result. Intestinal contents are more often poured out from

typhoid perforation, as fæces are not commonly found in the cæcum.

Dr. John B. Deaver said he had had some experience with perforation of the appendix during typhoid fever and had successfully operated on cases of this type. Recently he saw a case in which perforation of the appendix and of the intestine both occurred. The condition of the patient was such that operation was not advised, and death soon followed. Autopsy showed a perforation of the appendix and also one of the ileum at a point six inches above the ileocæcal junction. It is generally proved bacteriologically in these cases that the appendicitis is typhoidal in origin. Dr. Deaver has seen but little of intestinal obstruction during typhoid fever. Recently he operated on a case of intussusception, the diagnosis of which was made by an observant resident physician (Dr. Becker) at the German Hospital. The patient was a woman in the third week of typhoid fever, in whom there developed abdominal pain, shock and fall of temperature. She had not the pronounced rigidity which is so characteristic of perforation. Operation revealed an intussusception of the ileocolic variety, including the ileum for four inches above the ileocæcal valve. It was easily reduced, and in so doing there was exposed an ulcer the size of a quarter. There were also ulcers in the ileum. The patient is now convalescing. Dr. Deaver regards the second case of Dr. Roberts as one of volvulus which was reduced by manipulation.

Dr. John H. Gibbon said the cases reported by Dr. Roberts emphasize the fact that one should operate during typhoid fever if the symptoms warrant it, even though the condition does not suggest perforation. Medical men want the surgeon to assure them that perforation has occurred before they consent to operation. This assurance cannot in all cases be given. The point is that in all cases with pronounced symptoms operation is warranted; if perforation be not found, usually some condition demanding interference, as in the cases of Dr. Roberts, will be present. Dr. Gibbon has operated on two cases of appendicitis during typhoid fever. In one, three ulcers were present, blocking the appendix and causing all the symptoms of appendicitis with an abdominal crisis. The physician asked if he was sure of perforation, and was told no. Operation was then refused, but permission was finally obtained after insisting that the

symptoms warranted opening the abdomen. Dr. Roberts's cases show that one should open the abdomen if the symptoms warrant it, even with the lack of a definite diagnosis.

Dr. William J. Taylor has operated on two cases of appendicitis occurring during typhoid fever, but operated before the appendix perforated; both patients recovered. He believes that when abdominal symptoms in cases of typhoid fever lead one reasonably to suppose there is appendicitis, then he should operate. Both of his patients were benefited by the operation. He intends continuing the use of this method of treatment.

Dr. Gwilym G. Davis said that he did not mean to suggest that Dr. Roberts's case was one of typhoid perforation of the appendix. He has operated on one case of perforation of the appendix during typhoid in which there was also an additional intestinal perforation present.

Dr. Richard H. Harte regards Dr. Roberts's experience as emphasizing the old statement, "When in doubt, operate." There are so many complications during and after typhoid fever that we are led to regard numerous cases as doubtful; this is because no one can tell what is going on within the abdominal cavity. In many cases distinction is not possible, and the surgeon really can only guess what is the lesion; in all these cases operation should be performed. It is a wonder that there are not more cases of volvulus during typhoid fever than are reported, but it is not a common condition. By his colleagues present at this meeting at least one hundred cases of typhoid perforation have been operated upon, the greater number of which were diagnosed before operation, yet Dr. Harte ventures the assertion that among them was no case of volvulus. There are many curious conditions in typhoid fever. In some cases there is a great deal of abdominal rigidity, though in many of these there is no perforation. Cases in which there is sudden onset of abdominal pain, with tenderness and rigidity and a peculiar facial expression, are very important as indicating perforation. In all doubtful cases it is wise to open the abdomen, as this procedure does not materially affect convalescence. Of the 26 cases Dr. Harte has thus treated, two had no perforation, but both patients made satisfactory recoveries. As a sequel of typhoid fever, some cases present, a few months or a year afterward, marked peritoneal irritation, probably due to cicatricial

contractions. Where the intestine has been studded with ulcers there must necessarily be a great deal of contraction. As a rule these patients die, but a few recover, and these later present curious symptoms of partial obstruction, which is frequently relieved by the intelligent use of purgatives.

Dr. George Erety Shoemaker said that definite localizing symptoms indicating the presence of an acute disabling lesion call for operation during typhoid fever just the same as at any other time. He has operated for appendicitis in one case during typhoid and the patient recovered.

Dr. Francis T. Stewart has operated on several clear cases of appendicitis during the course of typhoid fever, and upon three other cases illustrating the possible findings in cases of like character. One was regarded as typhoid perforation of the appendix, there being in that organ a punched-out ulcer from which fæces were oozing. Recovery. In the second a diagnosis of perforation was made, but operation showed suppurative peritonitis and no perforation. The patient recovered. The third case was diagnosed appendiceal abscess in the course of typhoid fever; operation revealed an enormous mass of mesenteric glands below the cæcum. The peritoneum was clean, and there was no pus in the glands. The patient died of typhoid toxemia at a later period.

Dr. Astley P. C. Ashhurst said that there appeared to be no question that appendicitis is a much less severe condition during typhoid fever than is intestinal perforation. Some patients recover from the appendiceal lesion without operation, and practically all with unoperated intestinal perforation die. Patients who develop appendiceal symptoms during the early stages of typhoid fever usually recover whether operation is performed or not; but during the height of the typhoid fever both statistics and experience show that it is best to postpone operative interference unless it is very certain that the appendix is perforated or that peritonitis has occurred without actual perforation. Dr. Ashhurst had in mind now the case of a child, recently seen, who was suddenly seized with abdominal pain and vomiting. No clear history was obtainable, but in addition to extreme tenderness over the appendix there was high fever and slow pulse. The fever was too high and the pulse too slow to be typical of appendicitis, so the girl was sent to the Penn-

sylvania Hospital with a diagnosis of typhoid fever. The course of the disease was long and severe, the child being in the hospital ten or twelve weeks, but finally recovering. It seems probable that typhoid lesions in the appendix caused early irritation, and that recovery would have followed operation early in the attack, just as it did although no operation was performed. The case of intussusception during typhoid fever, included in the statistics published by Dr. Harte and the speaker, and referred to by Dr. Roberts, was one of the Episcopal Hospital cases operated upon by Dr. Hutchinson. The intussusception was gangrenous and irreducible, and a resection of the gut was therefore done, with circular enterorrhaphy; but the patient was too ill to stand the shock of the operation and died shortly afterwards.

Dr. Robert G. Le Conte said it must be remembered that the diagnosis of an acute abdominal crisis in the course of typhoid fever is often uncertain, particularly in the third and fourth weeks of the disease, when the patient is markedly adynamic with either stupor or delirium. Under such circumstances the three cardinal symptoms of peritonitis,—namely, pain, localized tenderness and rigidity,—are often absent, and few of the secondary symptoms may be present, such as changes in temperature and pulse rate, vomiting, distention, dullness in the flanks, etc. In these cases the surgeon cannot make a diagnosis of perforation at his first visit, for the symptoms present are so masked by the toxemia of the patient, or come on so insidiously, that an exact diagnosis is not possible.

Dr. Le Conte then briefly detailed two cases.

The first, seen about two weeks ago, was a woman of twenty-five in the fourth week of typhoid fever. She was delirious, picking at the bed-clothes, and profoundly toxic. The abdomen was distended and tender, but there was no rigidity, and no pain was complained of; no change in the temperature or pulse-rate, and the ear could not detect signs of peristalsis in the abdomen. An immediate operation revealed perhaps more than a quart of pus in the abdominal cavity, which was free from adhesions.

The second case, seen to-day, was a boy of seventeen, in the nineteenth day of his illness. He was profoundly stuporous and toxic. The abdomen was distended and rigid, with

some tenderness; no change in the temperature or pulse-rate. The attending physician had diagnosed perforation. In consultation with Dr. Harte it was agreed that an exploratory incision should be made, but that the diagnosis of perforation was doubtful. The abdomen was opened and no sign of peritonitis was present.

Both cases were markedly distended, and in neither was there any alteration in the temperature or pulse. The one with peritonitis had tenderness but no rigidity, while the other was rigid without any mark of tenderness. These cases illustrate the difficulties of an exact diagnosis at the first visit, and yet in both an immediate operation was deemed advisable.

DR. ROBERTS, in closing, said he was indebted to Dr. Davis for calling attention to his erroneous verbal statement in regard to the comparative mortality of perforation in the appendix and the ileum in typhoid fever. The statement was not contained in his paper, but was made during the introductory remarks. He rather feels that appendicitis, if it be not true typhoidal appendicitis, should be operated on in typhoid patients with pretty much the same urgency as in appendicitis occurring in patients not suffering from typhoid fever. A carefully-performed operation in competent hands, with proper surroundings, will probably not influence unfavorably the course of the enteric fever. It may even be done under local anæsthesia, if general anæsthesia is considered unwise.

ON THE USE OF THE MASLAND SAW FOR OPENING THE CRANIAL VAULT.

DR. H. C. MASLAND read a paper with the above title (for which see page 161).

DR. M. H. CRYER said that about 1891 a circular saw was devised with various guards to regulate the depth of penetration, also with an underguard which would pass between the dura-mater and the inner plate of the bone, thus dissecting the membrane from the bone and preventing the saw from cutting it. This instrument with an upper guard was used by him in helping Dr. W. W. Keen to open the brain-case for the removal of the Gasserian ganglion on October 18, 1893. The following is a quotation from Dr. Keen's report of the case: "An omega-

shaped incision was made the length of which vertically was three inches; one leg terminated in the front of the tragus, the other just in front of the junction of the anterior and middle, third of the distance between the auditory meatus and the external angular process. The temporal artery was cut, and that and a few vessels required ligation. Dr. M. H. Cryer, with a surgical engine of S. S. White Co., and a circular saw one and a-half inches, with guard, then rapidly and very successfully divided the external table excepting at the two extremities."

On receiving the invitation to discuss Dr. Masland's paper, Dr. Cryer went to his instrument morgue and resurrected this instrument spoken of by Dr. Keen as doing the work "rapidly and successfully." Tied to the instrument is another upper guard so arranged that the blood would not be thrown upwards. There are also two lower guards with it, intended to dissect away the dura and at the same time prevent the saw from cutting it, all of which is quite similar in principle to those described by Dr. Masland.

Although the circular saw with its upper guard worked fairly well, Dr. Cryer was not satisfied with it, as he felt that for his use an instrument must be made that would cut any thickness of skull in straight or curved lines without withdrawing the osteotome, and with great rapidity and absolutely no damage to the dura-mater. A guard therefore must be made to work on the inner side of the skull, and must be capable of turning on a very short curve without catching or tearing the dura. As such an instrument had been thought of at the time of the Keen operation, it was but a short time afterward that the one known as the spiral osteotome, with its underguard, was devised and used by others as well as himself. This cutting instrument has been spoken of as a drill by Dr. Masland. This is quite a mistake, as a drill is known to mechanics as an instrument for drilling a hole, usually in hard substances such as stone, metal, etc. The instrument in question is not a drill, as it would be impossible to drill or even bore a hole with it. It is as absolutely a side cutting instrument as any saw could be; in fact, in one sense it is a circular saw with three teeth or spiral blades cutting in the line of its shaft instead of at right angles. The instruments were presented. There are three hand-pieces which are all interchangeable with the instru-

ments. In one hand-piece there is a very small trephine for making the initial opening if so desired; in another a spiral osteotome with its guard which cuts a kerf about one-eighth of an inch in width. In the third a spiral osteotome which is somewhat finer and cuts a less track. A still finer one can be used. This instrument is the ideal one to the speaker for opening the brain-case. It may not be for others, as to a certain extent each one should judge for himself, as every man ought to use the instrument with which he knows he can do the best work. But apart from the advantage of having a person use the instrument to which he is most accustomed, the best appliance is undoubtedly that which is so constructed that it can be used successfully by the greatest number of men and do its work well under the greatest variety of circumstances. For this reason the younger surgeons should adopt the use of the most modern and efficient instruments that are presented to the profession.

The circular saw, driven by a light spiral cable for craniotomy, has inherent defects. The cable does not give a steady motion, it is liable to have what is known as "back-lash," and will chatter if the saw becomes the least bound or if a greater force is suddenly required. The saw cannot be used in making a curved incision when cutting the full depth of bone. It has to be lifted out for each change of direction, and will make an ugly cut at corner. It cannot be regulated by an upper guard to the varying thickness of the skull that is being cut. An underguard, if properly constructed, would allow any varying thickness to be cut, but an extra opening would have to be made by a trephine or the mallet and chisel to allow the entrance of the guard for nearly each direction cut. This would take considerable time. For these reasons he had long ago discarded the use of the ordinary circular saw with its upper and lower guards.

Dr. Thomas C. Stellwagen said he did not question the efficacy of the instruments of Drs. Masland and Cryer in their own hands, but personally he had tried them and found that special training was necessary for their use. This is especially needful to avoid injury to the brain and to the middle meningeal artery. None of these instruments can be thoroughly controlled, and to use them safely the surgeon must be trained by many

operations on the cadaver and by using the instrument every day. The Masland saw is difficult of sterilization when oil is being slung from it, as is constantly done. As to beveling the edge of the bone, this is not necessary. In a number of cases the bevel is not of great advantage. Another point is that the external table and diploe should be sawed and the internal table broken with a chisel instead of being sawed through as is done with these instruments. It is impossible to saw through the inner table without injuring the dura unless the operator is perfectly trained. None of these special instruments, including the one devised by himself, is being used by surgeons, because they have not time to perfect the use of the device.

Dr. Gwilym G. Davis saw a year ago an instrument devised by Dr. Codivilla, of Bologna, which very closely resembled that of Dr. Stellwagen. As to the general question of surgical engines, they may be used to bore holes and they can be used with burrs, trephines and saws, as shown by the demonstrators. He became interested in the matter some years ago, and found that for boring ordinary holes the engines are admirable. There is some difficulty in sterilization and in other points, but these give no special trouble. When it came to using burrs he found he could obtain better and quicker results with a mallet and gouge. With the trephine he used the engine in an intracranial neurectomy case. A guard was carefully applied, and he practised diligently on the dead body until he could cut just to the dura-mater without injuring that structure. On the patient, although he was more careful than with the cadaver, the trephine cut entirely through and brought up the dura with the bone. The patient died of meningitis. He then tried opening the skull with saws, but found it difficult to get saws that would work. Guards were made for the saws, but this method was finally abandoned because it was necessary first to make a trephine opening and also because the guards, in order to work, were so thin that they were liable to perforate the dura. It was desirable that the saws should cut a circle, and he had saws made for this purpose, but a guard could not be used with them and there was a tendency to jam. This latter fault is common to all these mechanical saws. His engine is now in the anatomical laboratory and he concludes they are all of little practical value except Dr. Cryer's method of first open-

ing the skull and using his recently perfected fine cutting osteotome. In his work he prefers a gouge instead of an engine. The bevel of the gouge should be on the under side, however, instead of upper, as they are commonly made.

DR. JOHN B. ROBERTS said that he had long been interested in improvements in methods of opening the skull. Some twenty years ago he had suggested and experimented in making openings of various shapes in the skull by means of a flat burr driven by the dental engine. This was before surgeons knew that osteoplastic cranial flaps were practicable, and that pieces of bone could be replaced in the trephine opening with the probability of retaining life and closing the opening. He published a paper on this subject at that time in the Philadelphia *Medical Times*. Subsequently he had devised an aseptic trephine, which has been a good deal used, and also invented a segment trephine for removing a button when the thickness of the skull varied very much in different parts of the circle to be removed. At the present time he feels a little inclined to agree with Dr. Davis in the opinion that many of the modern devices driven by electric motors are too complicated to be employed in occasional operations. They are, however, undoubtedly valuable in large hospitals, where they can be kept in order and where they will be frequently needed.

DR. CRYER, in closing, stated his preference for the straight barrel trephine for making the initial opening, which, if held perpendicularly to the skull and with the hand resting upon the skull, can be accurately manipulated. It takes practice to use it properly; then one can use the instrument without injuring the dura. He showed another instrument which stops when it passes through the bone, and no amount of pressure will make it go deeper, as it is made to choke when it passes through the hard tissue. In all delicate surgical operations he prefers the "cord" engine, because it runs without vibration or "back-lash," the hand-piece carrying the cutting instrument can be carried in any direction without moving the engine, and if the cutting instrument is caught the cord will slip and practically no harm be done. One disadvantage with instruments of the type shown by Dr. Masland is that the hand-piece being fastened to a comparatively rigid shaft, the operator cannot cut the various sides of the flap without moving the entire

engine, which would be very inconvenient, besides impracticable in actual surgical work.

DR. MASLAND, in closing, said that the back-lash of the dental cable is prevented here by dispensing with the flexible wrist connection, and using a heavy cable. The attendant who has charge of the motor can at the same time gently support the cable, and so prevent any drag it might otherwise have on the saw. The cable is superior to the belt in that both cable and sheath can be sterilized, whereas with the belt we have an unsterilizable and rapidly moving belt and gear in immediate proximity to the seat of operation.